



FRIDAY, SEPTEMBER 10.

## Railroad Accidents by the Earthquake.

The following accidents to trains are reported as caused by the earthquake last week:

A telegram from Charleston dated Sept. 2, says:

"Near Ten-Mile Hill a fatal accident occurred on Tuesday night. The down Columbia train (South Carolina Railroad) jumped the track. Engineer Burns and Fireman Arnold, colored, were badly injured by the tremendous leap which the train took in the dark under the unseen influence of the shock that dismantled the road. It is said that the earth suddenly gave way and that the engine first plunged down the temporary declivity. It was then raised on the top of the succeeding terrestrial undulation, and having reached the top of the wave a sudden swerving of the force to the right and left hurled the ill-fated train down the embankment. How it was done was plainly indicated. In many places along the track of the South Carolina and the Northeastern railroads, and for spaces of several hundred yards in width, the dreadful energy of the earthquake was expended in two particular ways. First, there were intervals of a hundred yards and more in which the track had the appearance of having been alternately raised and depressed, like a line of waves frozen in their last position. The second indication was where the force had oscillated from east to west, bending the rails in reverse curves, most of them taking the shape of a single, and others of a double letter S placed longitudinally. These latter accidents occurred almost invariably at trestles and culverts. There were no less than five of them between the Seven-Mile Junction and Jedburg. In other places the track had the appearance of being kinked for miles, but always in these cases in the direction of the rails. The train at the time of the earthquake was running along at the usual speed, and when about a mile south of Jedburg it encountered a terrible experience. It was freighted with hundreds of pleasure-seekers returning from the mountains. They were all gay and happy, laughing and talking, when all of a sudden, in the language of one of them, the train appeared to have left the track and was going up, up, up into the air. This was the rising wave. Suddenly it descended, and as it rapidly fell it was flung first violently over to the east, the side of the car apparently leaning over at less than an angle of 45 degrees. Then there was a reflex action, and the train righted and was hurled, with a roar as of a charge of artillery, over to the west, and finally subsided on the track and took a plunge downward, evidently the descending wave. The engineer put down the brakes tight, but so great was the original and added momentum that the train kept right ahead. It is said on trustworthy authority that the train actually galloped along the track, the front and rear trucks of the coaches rising and falling alternately. The utmost confusion prevailed, women and children shrieked with dismay, and the bravest hearts quailed in momentary expectation of a more terrible catastrophe. The train was then taken back in the direction of Jedburg; and on the way back the work of the earthquake was terribly plain. The train had actually passed over one of those serpentine curves already described."

A telegram to the New York Tribune, describing the effects of the earthquake at Langley Mills, on the South Carolina Railroad, a few miles east of Augusta, says:

"On the upper left hand side of the pond a tragedy had occurred. The first break of the levee that encircled the body of water took place there. The water rushed across the railroad track, carrying the ties and rails into a smaller pond just beyond just as the night express came thundering along. The night was very dark and a short curve hid even the glistening waters. The engine followed the dislocated track and plunged into the smaller pond. The fireman jumped and was thrown with tremendous force into the water and instantly drowned. The engineer stuck to his post, and though the engine was completely submerged managed to escape with two broken legs. None of the passengers were hurt."

"Almost at the same moment and precisely the same hour the up-bound express plunged into a crevasse, a mile below the pond and the fireman was killed, the engineer and passengers escaping."

## A Railroad Officer on the Labor Question.

Mr. S. H. Church, Superintendent of Transportation of the Pittsburgh, Cincinnati & St. Louis road, has the following letter in the *Century Magazine* for September:

A common suggestion in what has been written on the labor question is, that arbitration can accomplish a settlement of the existing difficulties and those of a kindred kind that may occur in the future. But the theorists seem to lose sight of the fact that only one side of the arbitration would be a responsible side, viz., the side representing the industrial establishment against which the demands of the laborers are advanced. In a recent railroad strike a large amount of property was destroyed by violence, and when a proposition was made by the workmen to submit their grievances to arbitration, the other party put the question as to who would pay for these losses. On the refusal of the labor organization to assume this burden, the peace negotiations were stopped.

The only safeguard for both the workman and his employer is a written contract with sufficient surety. Let every man who employs workmen in large numbers divide his men into 12 classes, which are to be employed respectively from 1 to 12 months each. He will then make with the individuals of each class a written contract, binding himself to employ them for the period of time represented by the class to which they are assigned. Any cause which will void the contract, such as negligence or the indulgence of bad habits on the part of the workman, and the failure to pay the wages agreed upon, or other default, on the part of the employer, are to be specifically enumerated in the instrument. Unless 10 days' notice is given by either party, the contract is to be renewed for the same period, and upon the same terms, immediately upon its expiration. The laborer has his side of the bargain protected by the pecuniary responsibility of his employer, and he must in turn give his employer a claim upon him by leaving in his hands up to the time of the expiration of his contract wages for a half-month; that is to say, a man belonging to the second class (which will insure his employment for the space of two months) begins to receive his wages on the first pay-day that occurs after he shall have been employed 15 days. If wages are paid by the month, he will not get his first pay for one month and a half. When his contract expires, of course he is settled with to date. Worthy employees will gradually be promoted from the shorter classes to the longer ones. Fluctuations in the seasons of production can be met by the employer giving the required 10 days' notice to any of the

shorter classes, that upon the expiration of their contracts their services would not be longer required. For the present. This condition of things would naturally result in elevating the best men into the highest classes, where their employment would be sure and steady, while the floating element—men without family ties—which is really responsible for much of the trouble and discontent so often engendered by the discussion of imaginary wrongs, would be kept in classes where they could be dispensed with as soon as it was found that they were not trustworthy. This plan would be an absolute protection to both sides. Should the men establish a strike, the employer has in his possession a forfeitable sum of their money, which, under the written contract, he has a right to appropriate. If, on the other hand, the employer is disposed to grind his men beyond reasonable endurance, those who consider the wrongs unbearable can give notice and quit.

Legislation on this subject will be without avail until there is a more harmonious feeling between the parties representing respectively capital and labor. A plan like that outlined above would make the capitalist absolutely secure in his ability to employ sufficient labor for any term within a year, at a known scale of prices; and the laboring man possesses in his contract an instrument which will protect him against the petty malice or unreasonable exactions of any sub-heads of departments, who would otherwise unjustly cause his discharge or call for undue work at his hands.

## The Poughkeepsie Bridge.

The contract to build the bridge over the Hudson River at Poughkeepsie, N. Y., has, it is announced, been taken by the Union Bridge Company, the work to be completed in 14 months. The bridge is described as follows by the *Engineering News*:

The bridge is to be of steel with five main spans of 525 ft. each, 'two of these to be on the cantilever principle.' The masonry piers will rise 30 ft. above the water, and on them will rise steel towers to a height of 135 ft. above water, supporting the bridge trusses, which will be 65 ft. deep. The bridge is designed for a double-track railroad on deck and will have a wide carriageway beneath, or through the trusses. The bridge proper is to cost \$2,228,000, and the approaches about \$2,000,000 more. These approaches will be made up, on the west side, of three spans of 80 ft. each and on the east, of a viaduct 2,000 ft. long. The President of the bridge company is Mr. Watson Van Benthuyzen, of New Orleans; F. P. Dickinson, we believe, is still Chief Engineer.

The foundations present considerable difficulty as to depth of water and character of material beneath. The water is from 50 to 60 ft. deep, with a bed beneath of 20 ft. of sediment and mud, 10 to 40 ft. of blue clay, 6 to 10 ft. of sand and 10 to 15 ft. of coarse gravel, with bowlders overlying the rock, which is at a depth of 119 to 145 ft. below the water surface.

The pier foundations now in place are open timber caissons filled with concrete and rest upon the gravel stratum. The caissons are 60 by 100 ft., and are built of yellow pine and white hemlock, 12 in. square. They are divided by transverse and longitudinal walls into 12 compartments arranged with cutting edges beneath, and sinking pockets filled with concrete over the outside and cutting edges. The material was removed from these compartments by the aid of clamshell dredges, the sinking being controlled by the manner in which the various compartments were dredged out. The concrete was deposited with similar dredges in masses of 4 or 5 cubic yards at a time. The caissons will average 2,500,000 ft. B. M. each of timber and 350 tons of wrought-iron.

The design for the open caissons is claimed for W. G. Coolidge, formerly of the American Bridge Co.; but we are credibly informed that the original plan was suggested by Mr. O'Brien, a civil engineer long connected with the Adirondack Railroad Co. We cannot say what plan will be pursued by the company now in control for sinking the remaining piers.

## The Brotherhood of Locomotive Engineers on Strikes.

In Scranton, Pa., Sept. 5, a union meeting of the Brotherhood of Locomotive Engineers, attended by about 500 members of that organization, was held at the Academy of Music. Special trains from New York, Philadelphia and Buffalo brought large delegations of the order to Scranton during the forenoon, and immediately upon their arrival a business session was held, at which matters of importance to the brotherhood were discussed. The animadversions of certain members of the Knights of Labor upon Chief Engineer Arthur and the brotherhood during the strike in the Southwest called forth a spirited discussion, which resulted in the unanimous adoption of the following resolution offered by Nat Sawyer, of Division No. 145, and seconded by George H. Vantassel, Third Grand Assistant Engineer:

"Resolved, That we, as the representatives of the Brotherhood of Locomotive Engineers, assembled in union meeting in the city of Scranton, Pa., Sunday, Sept. 5, 1886, do at this time express to our Grand Chief Engineer, P. M. Arthur, our strong and decided approval of his actions during the recent labor troubles in the West and Southwest, regardless of the statement of the labor demagogues to the contrary, viz.: 'That the Brotherhood did not approve of his actions.' We desire to say to him: Continue in the future as you have in the past, as every act of yours has given entire satisfaction to every loyal member and well-wisher of the brotherhood. We adhere strictly to your agreements with the several companies. Carry out to the letter the compact, and if the agreement is broken, let it not be said you were the first to break it. Do your duty regardless of the threats or intimidations of any labor organization in existence, ever remembering our motto: 'We amalgamate with none.'"

Soon after the union meeting of the brotherhood a public meeting was held, at which the principal address was delivered by Grand Chief Engineer Arthur, who sketched the origin and growth of the organization. He said that much had been heard in the past year about labor organizations in this country, and that a good deal of prejudice existed against such societies. He was sorry to say that much of the prejudice was deserved; but he wished it to be emphatically understood that there was a distinction between the Brotherhood of Locomotive Engineers and all other organizations.

While he believed in organized labor, he also believed that capital had rights which are entitled to as much respect as labor. There were two sides to the question, and both should realize the important fact that their interests are identical. He described the first meeting of five engineers, at which the foundation of the present great organization was laid, with "Sobriety, Truth, Justice, and Morality" as its motto. Now the brotherhood has 321 subdivisions, with a membership of 20,000. In the past 17 years it has paid \$2,000,000 to widows and orphans and another \$500,000 to the needy and destitute. At present, he said, the brotherhood was on the best of terms with the railroad companies of the country, and its principal aim was to settle all such disputes as might arise amicably. Labor and capital should reason together in disposing of their differences. He said that had it not been for

the fact that the brotherhood had a written contract with the companies, it would have been impossible to hold the men during the strike on the Gould system. A written contract with the brotherhood was regarded as inviolate. Any organization could not expect to succeed that resorted to the pistol, the torch and the bludgeon. The employers as well as the employed should observe the golden rule. Addresses were also made by Congressman Scranton and Mayor Ripple.

## Contributions.

## Water Way for Culverts.

PROVIDENCE, R. I., Sept. 4, 1886.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In reply to "J. M. B." in the *Railroad Gazette* of Sept. 3, I would say that Clemann's "Railroad Engineer's Practice" gives the following rule, by Major E. T. D. Myers, for sizes of culverts:

$$A = c\sqrt{M}$$

"In which  $A$  is the area of the opening of the culvert in square feet,  $M$  is the drainage area in acres, and  $c$  is a variable co-efficient, depending on the country, and for which Major Myers recommends 1.6 in hilly, compact ground, and 1.1 in comparatively flat ground. In mountainous countries this may often be increased to 4." WATERMAN STONE.

[The question raised by this letter is discussed in another column.—EDITOR RAILROAD GAZETTE.]

## The Starting Power of Engines.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In looking hurriedly over the articles in your recent issues on slack and starting power of locomotives, it occurred to me that the true inwardness of this matter is not comprehended as generally as it might be, and I hope you will not take it amiss if I suggest as follows:

A train is not started in a practical railroad sense unless the locomotive is capable of continuing on with it at the same rate of speed. The phenomenon of trains being wholly in motion and then stopping, contrary to the powerfully expressed desire of the engineer, is a phenomenon of *vis viva*, as also is that of a locomotive showing *throughout one and often several revolutions* a greater pull on dynamometer spring than the theoretical pulling capacity of the locomotive. The locomotive performs work in storing energy of motion, while the forward part of the train is moved through a distance represented by the slack, in addition to the work of overcoming journal and rolling friction. As the latter part of the train (if it is a hard one to start) begins to move, the forward part loses velocity, the stored energy going to help move the rear of train. If the whole train gets into motion with such a slow velocity that the engine is not capable of overcoming the high friction at this low velocity, it will gradually lose velocity and stall, and in losing velocity the *vis viva* of the engine and tender will be gradually used up on the train, and will serve to increase for the time being at the same rate the pull on the dynamometer car spring. I have often found it to increase this pull 2,000 lbs. above what the engine could exert at a constant but as low rate of speed.

I have known the pulling power of a heavy locomotive stated at 2,500 lbs. higher than it should be, by throwing on hand brakes suddenly, and bringing the locomotive to a quick halt while working hard, and you can easily demonstrate this matter by stopping the train with brakes on cars only when the engine is not working at all.

[We should, perhaps, have said in discussing "The Starting Power of Locomotives," last week, that it would be practically impossible for an engine to continue for any distance to exert more than its normal cylinder tractive power. Still, it is to be remembered that there are two sources of extra resistance in starting a train: the need for communicating a certain minimum velocity to the train, say 4 or 5 miles per hour, which takes just so much power beyond what is required simply to turn the wheels, and the higher journal friction at the very lowest velocities, which is, undoubtedly, an element of some moment. If these two are overcome by a temporarily effective tractive power in excess of the effective average as given by the usual formula for cylinder tractive power, which our correspondent's letter gives additional evidence of, the train will be started if not too heavy, although its resistances for the first few hundred feet be considerably over the average tractive power of the engine. If it is too heavy, the train will come to a stop as our correspondent describes; if needlessly light, the time during which the temporarily available additional power will be needed and used will be correspondingly short, and perhaps zero. But coming in between these two there will be, of course, a point at which the train would continue in motion almost indefinitely without either gaining or losing velocity by continuous reliance on this (ordinarily) temporary additional tractive power.

The last is a point of no practical moment, since the load must be *precisely* right for it within a fraction of a ton, which it is not practicable to have it. We did not intend to imply the contrary if we did do so. But the interesting and important fact is that there is an *effective* increase of cylinder tractive power for starting a train, which is not a pure deception like such tests as "C." refers to in the last sentence of his letter. The locomotive cylinders do actually exert more

pull in certain positions than in others, and by the action of the springs and slack this maximum pull becomes the effective one in getting the train under way  
—EDITOR RAILROAD GAZETTE.]

#### Indicator Diagrams.

The indicator diagrams shown in the accompanying engravings were taken from a passenger locomotive on the Delaware, Lackawanna & Western Railroad by Mr. F. W. Dean. Those on the left-hand side were taken with a Thompson indicator, while those on the right-hand side were taken simultaneously on the other side of the engine by a new Crosby indicator.

The difference between the two sets of diagrams is very marked and very instructive and must be almost wholly due to the difference in the working of the indicators. The importance of using a good indicator on an engine running at a high number of revolutions has often been insisted upon, but these diagrams clearly show that it is also important to have the indicator in the best possible working order with short well protected pipes if accurate diagrams are to be obtained from a locomotive running at even a moderate speed.

The left-hand diagrams, those taken with a Thompson indicator, had the advantage of the shortest pipe possible, well wrapped so as to protect it against radiation. The diagrams were taken from the front end of the right-hand cylinder.

The diagrams shown on the right-hand side of our illustration were taken from both ends of the left-hand cylinder, the pipes being long, but well wrapped.

Many of the imperfections of the right-hand diagrams are therefore probably due to the long pipes, and not to the construction of the indicator. It seems probable, also, that the presence of some grit in the piston of the indicator affected the right-hand diagrams. The difference between the two sets of diagrams shows what care should be exercised in every particular, in order to obtain a trustworthy record.

The diagrams given have some characteristic marks which show the defective working of one of the two indicators used. Generally speaking, it will be found that the left-hand diagram shows a fall in the steam line immediately after admission, while in the right-hand diagram the pressure does not fall until the piston has traveled some distance. This is peculiarly observable in diagrams 1 and 2 and 5 and 6. These right-hand diagrams are probably wrong in this respect, as it is obvious that the steam cannot, without material loss of pressure, follow the piston when the latter is moving at any great rate of speed. In diagram No. 1 the left-hand diagram shows an initial pressure of 134 lbs., which is 13 lbs. above that shown by the other indicator at the same time, but in the opposite cylinder. In the right-hand diagram the pressure does not fall until the piston has traveled 10 in., while in the left-hand diagram the pressure has fallen some 12 lbs. at this point. The piston at this part of the stroke is moving at the rate of 545 ft. per minute, and as the valve is nearly closed, say  $\frac{1}{2}$  in. open, the area of opening would be about 3 sq. in. Now the area of the piston,  $19\frac{1}{2}$  in. diameter, is 288 sq. in. Therefore, the ratio between the port opening and the area of the cylinder is as 1 to 96. Consequently, in order to follow up the piston, the steam would have to rush through the port at the rate of  $96 \times 545 = 52,320$  ft. per minute. This is at the rate of some 9.9 miles per minute, or 594 miles per hour.

It is evident that the loss of pressure through friction, in passing through this narrow opening at this immense speed, must be considerable, and it would be utterly impossible for the steam to flow at this speed unless there was a considerable difference of pressure between the steam-chest and the inside of the cylinder to induce this flow. But, according to the right-hand diagram, the difference was no greater when the piston was traveling with some speed, having accomplished 10 in. of its stroke, than when it was commencing the stroke and was consequently traveling very slowly. It is, therefore, evident that the right-hand card No. 1 is incorrect as regards the steam line.

In diagrams No. 4, however, the difference in this respect is all the other way. The left-hand diagram shows the least loss of pressure, 27 lbs., while the right-hand diagram shows a loss of 30 lbs. at half stroke. The differences between these diagrams are astonishing, and show that all indicator diagrams should not be trusted indiscriminately.

#### DIAGRAMS NO. 4.

Indicator.	Thompson.	Crosby.
Initial pressure	135	126
Pressure at half stroke	108	98
Minimum back-pressure	10	17 $\frac{1}{2}$

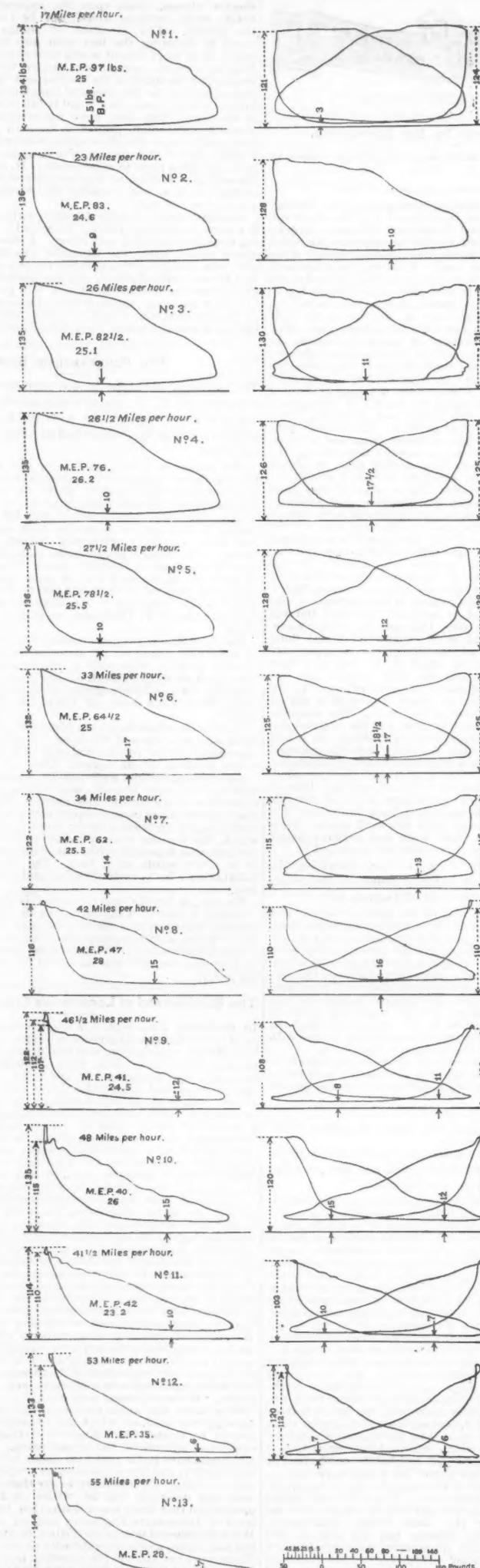
if such enormous differences exist at  $26\frac{1}{2}$  miles an hour, a very moderate speed for a passenger engine, what reliance can be placed on an indicator at a high speed, 50 miles per hour or over, where the difficulties of obtaining a correct diagram are very obvious?

Some of the differences may be very clearly seen in Diagrams Nos. 11 and 12, taken at  $41\frac{1}{2}$  and 53 miles per hour respectively. Here the most conspicuous difference is in the compression line, the form of which will be found to differ immensely in the two diagrams. In No. 11, there is a difference of fully 10 lbs. in the initial pressure.

*Particulars of Indicator Cards, Delaware, Lackawanna & Western Railroad.*

Locomotive No. 158.	Cylinders, dia. and stroke	$19\frac{1}{2}$ in. $\times$ 24 in.
	Drivers, dia.	68 in.
	Weight engine	95,000 lbs.
	Weight tender	60,000 lbs.
	Tractive power per lb, average	120.1 lbs.
	Pressure in cylinders	45.25 lbs.
	Number of cars	Seven.
	Weight " "	360,000 lbs.

The mean effective pressure given in the table herewith is that theoretically possible with the given cut-off and the given initial pressure, and an absolute vacuum, no allowance being



INDICATOR DIAGRAMS FROM PASSENGER LOCOMOTIVE: DELAWARE, LACKAWANNA & WESTERN RAILROAD.

made for back pressure, compression, wire-drawing or pressure release. In a non-condensing engine the loss due to the pressure of the atmosphere is of course inevitable, and some amount of compression is absolutely necessary to insure running smoothly at any speed. A portion of the loss shown,

at least 20 lbs., is therefore due to inevitable causes, and could not be prevented by an absolutely perfect valve-gear.

It will be seen from the table that the diagram No. 1, taken at a slow speed, shows a loss of only 30 lbs. In other words, the average pressure actually obtained on the piston is only

PARTICULARS OF DIAGRAMS TAKEN WITH THOMPSON INDICATOR.  
(Left-Hand Diagrams in Illustration.)

NO. OF DIAGRAM.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
Time taken, p. m.	4.52	4.55	4.57	5.00	5.4	5.12	5.21	5.27	5.30	5.35	5.37	6.20	6.26
Boiler pressure, pounds.	135	137	137	137	135	132	128	125	120	130	135	135	135
Initial pressure, pounds.	134	136	135	135	136	132	122	116	107	115	110	118	?
Revolutions.	86	116	130	132	138	166	171	209	232	240	208	263	275
Speed, miles per hour.	17	23	26	26.5	27.5	33	34	42	46.5	48	41.5	53	55
Throttle.	5	8	8	8	8	8	8	8	8	8	8	9	10
I. H. P.	573	666	739	692	746	739	719	678	656	602	603	535	533
Cut-off, in.	12 $\frac{1}{4}$	13 $\frac{1}{4}$	12 $\frac{1}{4}$	11	11	11	?	?					
Mean theoretical effective pressure	127	129	128	128	129	125	117	112	98.5	105	101	—	—
Ditto actual, pounds.	97	83	82.5	76	78.5	64	62	47	41	40	42	35	28
Loss, pounds.	30	46	45.5	52	50.5	61	53	75	57.5	65	59	—	—
Grade, ft. per mile.	75.5	75.5	75.5	75.5	53.3	53.3	13.7	25.3	24.6	24.6	17.4	27.4	—
Steam per I. H. P. per hour, pounds	25	24.6	25.1	26.2	25.5	25	25.5	28	24.5	26	23.2	—	—

30 lbs. per sq. in. below that possible with a perfect valve-gear and perfect expansion, the steam being exhausted into a condenser with a perfect vacuum. This is a very good result, and in practice is not often exceeded in a locomotive with a cut-off at about half-stroke or earlier. The loss increases rapidly with the speed, especially when it is borne in mind that in this method no account is taken of the loss caused by insufficient throttle opening. If the boiler pressure instead of the initial pressure in the cylinder were taken, the loss would be greater and would increase still more rapidly with the speed.

The table above shows how great is the loss of effective pressure on the piston caused by the increased back pressure and wire-drawing when an engine is running at even a moderate speed with a tolerably late cut-off. The diagrams 2 to 8 inclusive are all taken with the same cut-off and with the

ure on her pistons fell, leaving her a smaller margin of power to expend in gaining speed after having overcome the friction of the train and the resistance due to the grade. At 4.52 p. m. when diagram No. 1 was taken, she was exerting a gross pull of

$$97 \times 129.1 = 12,522 \text{ lbs.}$$

The gross weight of the train was 515,000 lbs., and as the grade of 75.5 ft. per mile is a rise of 1 in 70, the resistance due to gravity would be :

$$\frac{515,000}{70} = 7,357 \text{ lbs.}$$

In diagram No. 4 the gross tractive power of the engine was only

$$76 \times 129.1 = 9,812 \text{ lbs.}$$

As the engine had slightly gained speed since the previous

power available for increasing the speed of the train. If wider port openings and passages were used, the useful pressure on the piston would not decrease in such a rapid ratio. Suppose, for instance, that at 26.5 miles per hour, it had only decreased 7 instead of 21 lbs., the balance for increase of speed would be :

$$14 \times 129.1 = 1,807 \text{ lbs.}$$

It need hardly be pointed out that under these circumstances a high speed would be much sooner attained, and that the reversing lever might have been pulled up a notch several minutes before the top of the grade was reached, thus not only getting up the grade in less time, but with a smaller consumption of steam.

The lowest line in the table shows the weight of steam used per I. H. P. per hour. This is, of course, tantamount to saying that in this locomotive, from 23 to 28 lbs. of water was used per hour, per indicated horse-power developed. If 7 lbs. of water were evaporated per lb. of coal, this would give roughly from 8 $\frac{1}{2}$  to 4 lbs. of coal per I. H. P. per hour. Unfortunately, it is practically impossible to calculate from indicator diagrams the amount of steam used by an engine. In this case, it is believed that about 35 lbs. of steam were consumed per I. H. P. per hour. The figures, therefore, merely serve to compare the relative efficiency of the engine at different speeds and in different grades of expansion.

The results obtained in these diagrams probably represent fair average practice, and it must not be assumed that the losses shown are unusual, or show the Lackawanna engines to be wasteful machines. On the contrary, they do heavy work as well as any other locomotives. The losses merely show what is going on in the cylinders of the majority of locomotives running fast trains, and should teach us that there is a large margin for economy in the best existing locomotives, and that a little time devoted to the analysis of indicator diagrams will show where waste exists. The defect being located, the first step is taken in providing a remedy.

#### Brake Test Recording Apparatus—American Brake Co.

The accompanying engraving shows a very compact and ingenious apparatus devised by the American Brake Co. for recording all the necessary data to give the efficiency of brakes in making stops. It was placed in the middle car of each test train throughout the Burlington brake tests, and with it were taken the diagrams shown on the large inset plate which accompanies this issue, which are only selected samples of many others taken.

The various records taken by this single instrument—not all of which were used in making up the official notes—are as follows:

1. Beginning at the left-hand side of the diagram, a Boyer speed indicator, the invention of Mr. Joseph G. Boyer, of St. Louis, Mo., shows the speed in miles per hour on the high diagram.

2. On the paper roll just below the high dial the speed is recorded on a diagram which is fed horizontally at varying rates of speed; at one-half inch per mile for long trips and at about 100 ft. per inch for records designed to cover stops only.

3. On this diagram 5 second marks are made by a pencil actuated by an electric circuit from one of the batteries below passing through the clock and the magnet visible near the top of the high paper roll.

4. The low dial near the front of the table gives the distance run to the nearest foot after the apparatus is thrown into gear, which was done by the handle projecting through the box at the side until a single handle was finally placed on the shaft seen behind the two battery boxes to throw everything on the table into gear at once. One of the hands on the dial makes a complete circuit in 100 ft.; the other moves only one notch for 100 feet, or makes a complete circuit in 10,000 feet.

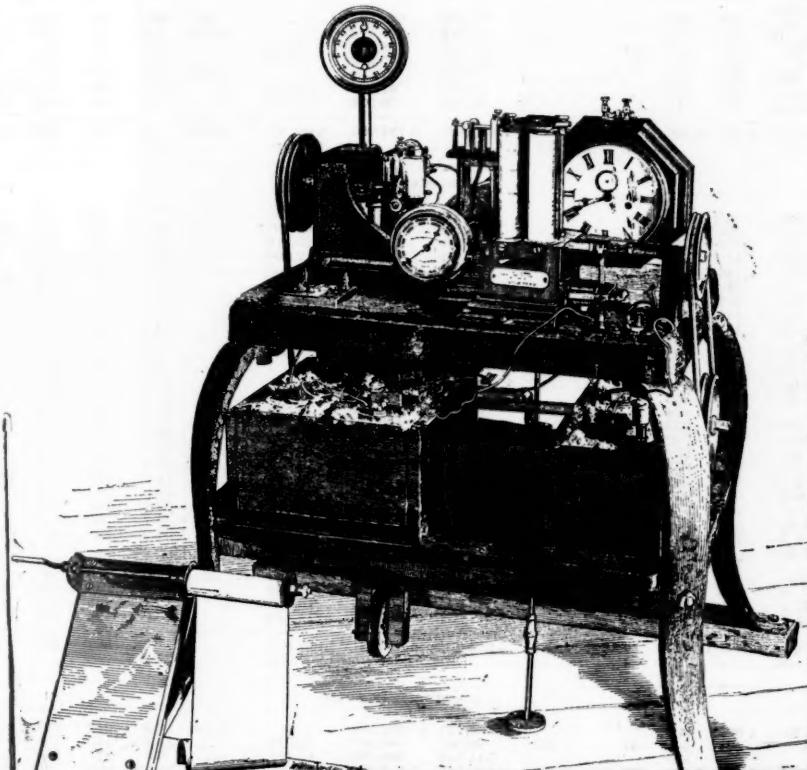
5. The rod seen running down through the floor connects with the brake-rod and actuates directly a pencil, concealed from view by the tall paper roll, which records on the latter continuously (it being fed by the same mechanism which actuates the distance indicator) the tension on the brake-rod, and hence (by multiplying the latter by the proper leverage) the pressure on the brake-beam.

6. Time-marks at 5-second intervals are placed on this diagram also by the same clock, but by an independent circuit.

Thus the four elements of speed, time, distance run and brake-beam pressure, are all given, but unfortunately only one of them, the brake-beam pressure, was given in an entirely reliable manner, owing not to any defect in the machine itself, but to a defect in the manner of actuating it, which was by belts. It proved impossible to make these belts work without slipping during the severe shocks to which the apparatus was subjected, and, moreover, the form of the tests made it difficult to make the feed exactly right even if it had been uniform. The brake-pressure diagrams were therefore the only ones which were not better given by the dynamometer car records. Were the apparatus actuated by a positive worm-gear feed, there appears no reason why it should not be able to render most excellent service.

The Boyer speed indicator consists in substance of a small pump, driven by the pulley at the left and the horizontal gear-wheel partly covered up by the casing. This pump acts on a column of mercury, and by the pressure which it produces indicates the speed. The apparatus seems to have been extremely well designed, the gauge being at once sensitive to real changes of velocity and reasonably steady. Its interior construction is very simple, and it worked perfectly throughout the tests except that the manner of driving it was imperfect.

The peculiar double worm-gear shown by the two small



BRAKE TEST APPARATUS, AMERICAN BRAKE CO., SHOWING BOYER SPEED INDICATOR.

same throttle opening, yet as the speed increases from 23 to 42 miles per hour, the average effective pressure on the piston falls from 88 to 47 lbs. per sq. in., a loss of 36 lbs. caused by an increase of speed of only 19 miles per hour. A small part only of this loss is caused by a decreased boiler pressure, for the mean pressure falls with almost absolute regularity, while the boiler pressure rises. Diagram No. 1 was probably taken with a boiler pressure very similar to that of the other diagram, but it will be seen that the average effective pressure on the pistons is over 50 per cent. in excess of that obtained with a wider opening or throttle in diagram No. 7. The cause is the increase in speed from 17 to 34 miles per hour. A great part of this loss of 35 lbs. is due to the increased back pressure which is 9 lbs. The greater back pressure, of course, causes the compression line to rise higher and faster and the increased speed causes the valve to practically close earlier. In other words, an opening of a given amount, say  $\frac{1}{8}$  in., means at 40 miles per hour, such a loss of pressure that the valve is practically closed. At 20 miles per hour this point is not reached until the valve is, say, only  $\frac{1}{2}$  in. open. The necessity for wide port openings in a fast passenger engine could hardly be more clearly shown than in these diagrams.

It has often been observed that engines with large ports and the Allen or Trick passage in the slide-valves get away quicker and attain a high speed sooner than engines with narrow ports and ordinary slide-valves. The reason is very clearly shown by these diagrams. Working with the same cut-off and practically the same throttle opening, the engine from which these diagrams were taken was 8 minutes in gaining speed from 17 to 26.5 miles per hour, working all the time on the same gradient. An increase of speed of only 9.5 miles per hour in 8 minutes is slow work, but what was the reason? As fast as the engine gained speed the useful press-

ture was taken, we may reasonably assume that this last figure fairly represents the total resistance of the train. Deducting gravity, the resistance due to friction, etc., appears to be 2,455 lbs., which is equal to 10.7 lbs. per gross ton weight of engine, tender and train.

Working out the results in a similar manner for Diagram No. 7, which was taken at a very slight increase of speed over its predecessor, and, therefore, probably represents the real resistance of the train, we find the friction of the train, after making proper allowance for gravity to be 2,805 lbs. or 12.2 lbs. per ton. If the friction at 26.5 miles per hour was 10.7 lbs. per ton and at 34 miles per hour was 12.2 lbs. per ton, it is reasonable to assume that at 17 miles per hour it did not exceed 10 lbs. per gross ton. If this was the case, the engine when Diagram No. 1 was taken was distributing her tractive power in overcoming resistance and gaining speed as follows:

Overcoming gravity due to grade..... Lbs.

“ friction of train..... 7,357

Accelerating speed of train..... 2,300

Total tractive power exerted..... 2,865

When, however, diagram No. 4 was taken, the gross tractive pull had so diminished and the frictional resistance, owing to the higher speed, had so increased that nothing was left for the work of accelerating the speed of the train. The figures may be assumed to be somewhat as follows:

Overcoming gravity due to grade..... Lbs.

“ friction of train..... 7,357

Total tractive power exerted..... 2,455

It will thus be seen that once this speed was attained, any increase on this grade was impossible, and if we examine the indicator cards 2, 3, 5 and 8 we shall find that the diminished area of the diagram due to the wire-drawing and increased back pressure gradually diminished the balance of tractive

wheels at right angles to each other was improvised during the tests to give the diagram paper a faster feed. The ordinary method is by a worm and wheel of the usual form.

The batteries used were unusually powerful, because the severe shocks to which the apparatus was subjected made a milder current unreliable. It was necessary to carefully pack the cells with waste in order to avoid breakage.

#### Burlington Brake Tests—Brake-Beam Pressure Diagrams.

We give, on the large inset sheet which accompanies this issue, some selected examples of the diagrams which were taken by the apparatus which is also illustrated in this issue, to show how, when and how forcibly the brake pressure was applied to the brake-beams of the middle car of the train.

The diagrams have been selected to give a fair idea of the actual working of each brake shown, which are the Westinghouse, Eames and American, these being the only ones which took a very active part in the competition. Similar diagrams for the Widdifield & Button brake were given in our issue of Aug. 13, 1886.

The length of each stop in feet is shown in figures on the dotted line which marks the termination of each, and the horizontal scale for each set of diagrams is likewise given. For some of the diagrams, but not all, a scale of seconds is shown.

No effort has been made to select diagrams which should fairly represent the lengths of the stops made, but only the action of the brake-beams, and the distance run in feet before the brakes begin to apply at all and before they were fully on. It will be seen that there are great and striking differences in this respect.

The Westinghouse diagrams show three runs, 25 car mixed loaded and empty trains, emergency stops; 50 empty car trains, emergency stops, and 50 mixed car trains service stops. The loading or absence of load in the cars, of course, makes no difference in the action of the brake pressure, except as it may make the stop longer and so afford more time for the pressure to act, but with both the air brakes it will be seen that the pressure, after it is once applied, which is very gradually, continues substantially unchanged to the end of the stop. Therefore, the only important facts which can be shown by these diagrams are, how long before the pressure begins and is fully on, and how great pressure is produced.

The speed has not been shown on any of the diagrams. Stops 1 and 3, however, were specified to be made at 20 miles per hour, and stops 2 and 4 at 40 miles per hour, and the variations therefrom were not great enough to make any very material difference.

For the Eames vacuum brake only two runs were shown, a 25-car mixed train run, emergency stops, and a 50-car loaded train, service stops. A run of a 50-car train with emergency stops might likewise have been shown to advantage, but was not at hand when the engraving was prepared. We add the essential notes of the runs shown in the following table, which shows the distance in feet from the beginning of the stop to when brakes began to act and were on full force:

WESTINGHOUSE.		EAMES.	
Brakes	Brakes	Brakes	Brakes
No. Stop Speed, began to on full cars.			
25 221 29.1 148	25 301 10.5 220	25 301 10.5 220	25 301 10.5 220
25 223 20.0 151	25 303 21.4 135	25 303 21.4 135	25 303 21.4 135
25 223 20.0 151	25 302 37.7 110	25 302 37.7 110	25 302 37.7 110
25 224 44.0 214	25 303 41.7 370	25 303 41.7 370	25 303 41.7 370
50 611 20.3 320	(470) (No 50 car emergency stops shown.)	50 611 20.3 320	(470) (No 50 car emergency stops shown.)
50 613 23.0 279	(580)	50 613 23.0 279	(580)
50 613 40.2 236	(690)	50 613 40.2 236	(690)
50 614 42.5 630	(1,100)	50 614 42.5 630	(1,100)

\* To a pressure of only 3,000 lbs against 4,000 lbs. normal maximum in emergency stops.

The indications are, so far as can be judged from the notes of the rear car, that with both the air brakes enough power is developed to move the brakes up to the wheel considerably sooner than any pressure sufficient to tell upon the brake pressure diagrams is developed, since the records of the rear car (averaging the very small variations which existed) showed the following time in seconds for the first beginning of brake pressure, as indicated by a pointer attached to the brake beam. Notes of the average pressure in train pipe at the head and rear of the train, just before the stop began, and in the auxiliary reservoir, and in the brake cylinder during the stop, are likewise added.

#### Rear Car Notes.

Westinghouse. Eames.  
25 car 50 car 25 car 50 car  
all braked. braked. braked. braked.  
Average time in seconds before brakes began to apply. 3@ 3 1/2 12@13 6 10 @12  
Average pressure in lbs. (or ins. of vacuum) in train pipe  
at rear car. 58@64 57@64 12 @14 11 @13 1/2  
at engine. 62@67 60@67 12 1/2@18 1/4 13 1/2@14 1/2  
In brake cylinder. 36@42 27@41 11 @12 10 @15  
In aux. reservoir. 57@64 18 1/2@21 17 1/2@21

\* The vacuum in train-pipe is worked up to 21 to 22 1/2 in. immediately after a stop, and then (after charging auxiliary reservoirs) allowed to fall to 12 1/2 to 14 in., which is just above the point at which brakes apply.

It is but natural that the brakes should apparently go on much before there is any really efficient pressure on the brake-shoes, since the very first air (or vacuum) which is admitted to the cylinders will suffice to push the brakes up to the wheels, but considerably more must flow in before there will be any measurable pressure. It looks very much as if

#### RAILROAD EARNINGS IN JULY.

NAME OF ROAD.	MILEAGE.					EARNINGS.					EARNINGS PER MILE.				
	1886.	1885.	Inc.	Dec.	P. c.	1886.	1885.	Inc.	Dec.	P. c.	1886.	1885.	Inc.	Dec.	P. c.
EASTERN ROADS.															
Balt. & Potomac	92	92				112,721	103,806	\$ 8,915			8.6	1,225	1,128	\$ 97	\$ 86
Buff., N.Y. & P.	663	663				245,719	210,318	35,391			16.8	371	317	54	16.8
Buff., Ro. & Pitts.	294	294				114,312	106,909	7,403			6.9	389	364	25	6.9
Camden & Atlantic	79	79				97,732	86,237	11,495			13.4	1,237	1,092	145	13.4
Danbury & Nor.	37	37				15,270	24,695	575			2.3	683	667	16	2.3
Grand Trunk	2,999	2,998				1,680,976	1,407,177	273,799			19.4	561	469	92	19.4
Long Island	354	354				391,661	373,079	18,582			5.0	1,107	1,054	53	5.0
N. Y. C. & H. R. W.	1,541	993	548		55.2	2,077,026	1,665,554	1,012,075			60.7	1,237	1,077	200	36.6
N. Y. City & No.	54	54				50,176	41,426	8,750			21.1	929	767	162	21.1
N. Y., L. E. & W.	1,075	1,075				1,506,194	1,308,180	288,014			22.1	1,485	1,217	268	22.1
N. Y. & Eng.	392	392				345,493	295,967	49,526			16.7	881	755	126	16.7
N. Y., Ont. & W.	321	321				144,711	136,071	8,637			6.2	451	424	127	6.2
N. Y., Sus. & W.	153	150	3	2.0		49,460	41,722	37,738			2.8	639	671	32	4.8
Northern Cen.	32	32				4,356,677	3,685,105	671,572			9.2	1,396	1,279	117	9.2
Penn. Railroad	2,340	2,268	72	3.1		2,763,166	2,641,851	121,415			4.6	1,771	1,694	77	4.6
Phil. & Reading	1,560	1,560				170,855	169,505	10,352			6.1	899	848	51	6.1
West Jersey	200	200													
Total, 17 roads	12,475	11,852	623			15,329,682	12,768,301	2,564,236	2,855		20.1	1,229	1,077	152	14.1
Total inc. or dec.						5.4									
SOUTHERN ROADS.															
Ala. Great So.	290	290				82,664	70,092	12,572			18.0	285	242	43	18.0
Cin. N. O. & T. P.	336	336				254,776	222,926	31,847			14.3	758	663	95	14.3
E. Ten., V. & G.	1,100	1,100				320,464	298,824	21,640			7.2	291	272	19	7.2
Georgia Pacific	317	317	7	2.3		57,765	42,452	15,213			36.2	182	137	45	32.2
Ill. Cen. So. Div.	711	711				250,251	232,072	18,229			7.9	352	327	25	7.9
Louis. & Nash.	2,015	2,015				1,259,774	1,057,332	202,442			19.1	625	525	100	19.1
Mem. & Charles	292	292				93,946	83,816	10,130			12.1	322	287	35	12.1
Miss. & Tennessee	100	100				24,541	23,851	690			2.9	245	238	7	2.9
Mobile & Ohio	680	680				148,266	130,226	18,040			13.0	218	192	26	13.0
N. Chat. & St. L.	580	580				213,256	165,067	49,589			29.4	371	286	55	29.4
N. O. & North E.	195	195				36,140	33,542	2,508			7.7	185	172	13	7.7
Norfolk & West.	510	510				250,280	210,476	45,804			22.0	503	413	90	22.0
Rich. & Danville:															
R. & Dan. Div.	960	960				271,400	272,277				877	0.3	283	284	1.0
Va. Midland D	355	355				125,784	130,570				4,786	3.6	354	368	14
W. N. C. Div.	290	276	14	5.1		42,368	38,833	3,535			9.1	146	141	5	3.6
So. Car. Div.	373	373				46,700	45,982	718			1.5	125	123	2	1.5
Gr. & Col. Div.	296	296				27,700	31,682				3,982	12.5	94	107	13
South Carolina.	246	246				74,785	61,138	13,647			22.4	304	249	55	22.4
Vicks. & Merid'n	143	143				31,127	29,574	1,553			5.2	218	207	11	5.2
Total, 19 roads	9,789	9,768	21			3,619,887	3,181,285	448,47	9,645			370	326	44	
Total inc. or dec.			21			0.2						13.9		44	13.6
CENTRAL GROUP.															
Cairo, V. & Chi.	265	265				68,873	38,124	30,749			80.6	260	144	116	80.6
Chi. & Atlantic	269	269				129,808	80,911	39,897			44.3	483	33	149	44.3
Chi. & East. Ill.	252	252				137,873	114,055	23,818			20.8	547	45		

## RAILROAD EARNINGS, SEVEN MONTHS TO JULY 31.

NAME OF ROAD.	MILEAGE.				EARNINGS				EARNINGS PER MILE.							
	1886.	1885.	Inc.	Dec.	P. c.	1886.	1885.	Increase.	Decrease.	P. c.	1886.	1885.	Inc.	Dec.	P. c.	
EASTERN ROADS.																
Balt. & Potomac.	92	92	.....	.....	.....	742,635	759,348	.....	.....	2.2	8,072	8,254	.....	182	2.2	
Buf., N. Y. & P.	63	63	.....	.....	.....	1,411,345	1,293,739	152,586	.....	11.9	2,181	1,951	230	.....	11.9	
Buf. & Rock. & P.	204	204	.....	.....	.....	622,550	661,220	.....	38,700	3.9	2,117	2,249	.....	152	3.9	
Cam. & Atlantic.	79	79	.....	.....	.....	312,250	292,276	.....	.....	6.8	3,953	3,708	253	.....	6.8	
Dan. & Norwalk.	37	37	.....	.....	.....	124,440	119,548	5,392	.....	4.9	3,377	3,291	146	.....	4.9	
Grand Trunk.	2,098	2,083	15	.....	0.5	9,118,840	8,240,814	878,035	.....	10.6	3,076	2,763	278	.....	10.6	
Long Island.	351	351	.....	.....	.....	618,142	1,512,524	575,618	.....	4.9	4,571	4,257	214	.....	4.9	
N. Y. C. & H. R.	1,541	993	548	552	.....	17,590,237	13,231,410	4,358,827	.....	32.9	11,415	13,325	1,910	14.4	14.4	
N. Y. City & N.	54	54	.....	.....	.....	304,528	240,031	64,495	.....	26.9	5,639	4,445	1,194	.....	26.9	
N. Y. L. E. & W.	1,075	1,075	.....	.....	.....	10,119,068	8,402,333	1,717,633	.....	20.5	9,414	7,816	1,568	.....	20.5	
N. Y. & N. Eng.	392	392	.....	.....	.....	2,137,647	1,809,882	327,765	.....	5.3	2,235	2,122	113	.....	5.3	
N. Y. Sus. & W.	15	150	3	.....	1.3	601,629	596,812	4,817	.....	0.8	3,058	3,079	0.12	70	0.5	
Northern Cen.	322	322	.....	.....	.....	3,031,861	3,009,494	22,367	.....	0.7	9,416	9,346	7.7	.....	0.7	
Penn. R. R.	2,317	2,268	59	26	.....	27,606,844	25,004,791	2,602,143	.....	10.4	11,864	11,025	839	.....	10.4	
Phila. & Rea. I.	1,560	1,560	.....	.....	.....	16,183,984	15,325,053	831,931	.....	5.4	10,374	9,841	533	.....	5.4	
West Jersey.	200	200	.....	.....	.....	725,496	680,290	45,197	.....	6.6	3,627	3,401	226	.....	6.6	
Total, 17 roads.	12,461	11,817	624	.....	.....	91,005,537	81,917,734	11,143,036	55,413	.....	7,404	6,920	544	.....	7.4	
Tot. inc. or dec.	.....	624	5.3	.....	.....	.....	.....	.....	13.5	.....	544	.....	7.9	.....	7.9	
SOUTHERN ROADS.																
Ala. & Gulf South.	293	290	.....	.....	.....	627,538	589,702	37,830	.....	6.4	2,164	2,033	131	.....	6.4	
Cin. N. O. & T. P.	336	336	.....	.....	.....	1,537,222	1,430,588	106,634	.....	7.4	4,575	4,258	317	.....	7.4	
E. T. Va. & Ga.	1,100	1,100	.....	.....	.....	2,211,831	2,191,049	20,782	.....	0.9	2,011	1,992	19	.....	0.9	
Georgia Pacific.	317	310	7	2.3	.....	406,173	339,956	66,217	.....	19.5	1,281	1,097	184	19.5	19.5	
Ill. Cen. S. Div.	711	711	.....	.....	.....	2,039,017	2,346,950	307,933	.....	13.1	2,688	3,301	433	13.1	13.1	
Louis. & Nash.	2,015	2,043	28	1.3	.....	7,549,011	7,892,190	352,149	.....	4.5	3,742	3,863	121	.....	4.5	
Mem. & Charles.	292	292	.....	.....	.....	688,946	695,749	6,194	0.2	2,360	2,381	21	0.9	0.9		
Miss. & Tenn.	103	100	.....	.....	.....	204,932	258,453	53,521	20.6	2,049	2,584	535	20.6	20.6		
Mobile & Ohio.	549	549	.....	.....	.....	987,846	1,017,223	50,377	5.7	1,799	1,906	109	5.7	5.7		
Nash. C. & St. L.	580	580	.....	.....	.....	1,296,065	1,022,885	103,180	.....	8.6	2,235	2,057	178	8.6	8.6	
N. Or. & N. E.	195	195	.....	.....	.....	336,909	378,922	42,013	11.1	1,728	1,943	215	11.1	11.1		
Nor. & West.	510	510	.....	.....	.....	1,705,068	1,447,506	258,162	.....	18.0	3,344	2,838	506	18.0	18.0	
Total, 19 roads.	9,658	9,665	21	28	.....	24,439,287	24,614,261	698,300	853,283	2.5	2,533	2,547	14	.....	2.5	
Tot. inc. or dec.	.....	7	0.1	.....	.....	.....	.....	154,974	0.9	.....	14	.....	0.5	.....	0.5	
CENTRAL GROUP.																
Chi. & East. Ill.	25	25	.....	.....	.....	923,506	856,464	67,042	.....	7.7	3,065	3,399	266	.....	7.7	
Chi. & West. Ill.	413	413	.....	.....	.....	708,293	715,755	52,538	.....	7.3	1,854	1,733	121	.....	7.3	
C. L. St. L. & Cb.	342	342	.....	.....	.....	1,409,301	1,326,711	82,590	.....	6.2	4,121	3,879	242	.....	6.2	
C. Wash. & Balt.	241	281	.....	.....	.....	1,061,036	954,570	116,457	.....	11.1	3,776	3,397	379	11.1	11.1	
Cleve. & Ak. & Col.	144	144	.....	.....	.....	287,871	275,791	12,280	.....	4.4	1,999	1,914	85	.....	4.4	
Clev. & Canton.	161	161	.....	.....	.....	193,422	166,891	56,531	.....	15.9	1,201	1,037	164	15.9	15.9	
Col. & Cm. M.	71	71	.....	.....	.....	168,772	102,888	55,884	.....	62.0	2,377	1,419	928	.....	62.0	
Col. H. V. & Tol.	328	324	4	1.2	.....	2,142,871	1,257,266	14,361	.....	3.7	3,789	3,880	91	2.3	2.3	
Det. L. & W. & Tol.	201	201	.....	.....	.....	670,966	647,438	23,552	.....	3.7	2,571	2,481	90	3.7	3.7	
Ev. & Terre H.	146	146	.....	.....	.....	322,139	305,673	26,485	.....	6.6	2,802	2,710	182	.....	6.6	
Flint & Fer. Mar.	362	362	.....	.....	.....	1,251,868	1,086,958	165,938	.....	15.2	3,439	3,003	456	15.2	15.2	
Grand R. & Ia.	404	404	.....	.....	.....	1,093,200	1,036,810	56,390	.....	5.4	2,706	2,655	141	5.4	5.4	
Ill. Cen. & Ill. line.	653	653	.....	.....	.....	3,455,97	3,512,288	53,375	1.6	3,626	3,086	60	1.6	1.6		
Ind. Bloom. & W.	532	532	.....	.....	.....	1,244,238	1,228,887	130,351	.....	9.8	2,536	2,310	226	9.8	9.8	
Ind. D. & Sonora.	152	152	.....	.....	.....	219,689	181,102	38,597	.....	21.3	1,445	1,191	254	21.3	21.3	
Louis. E. & St. L.	253	253	.....	.....	.....	457,848	387,024	70,314	.....	18.0	1,810	1,532	278	18.0	18.0	
N. Y. Penn. & O.	587	587	.....	.....	.....	6,415,349	5,272,840	1,145,509	.....	27.5	5,818	4,833	1,265	27.5	27.5	
Ohio & Miss.	615	615	.....	.....	.....	2,006,150	2,020,214	45,9	2.3	3,357	3,285	72	2.3	2.3		
Ohio Southern.	130	130	.....	.....	.....	261,488	226,830	34,658	.....	15.1	2,011	1,745	266	15.1	15.1	
Peoria, D. & E.	254	254	.....	.....	.....	407,784	381,021	26,763	.....	7.0	1,605	1,500	105	7.0	7.0	
Pit. Cin. & St. L.	201	201	.....	.....	.....	2,478,349	2,213,550	264,799	.....	11.9	12,330	11,013	1,317	11.9	11.9	
St. L. Al. & T. H.	195	195	.....	.....	.....	671,568	690,777	10,731	.....	1.0	3,444	3,389	55	1.0	1.0	
Main line.	138	138	.....	.....	.....	387,293	402,604	15,311	.....	3.8	2,806	2,917	111	3.8	3.8	
Bellefonte line.	2,234	2,234	.....	.....	.....	6,869,319	6,332,257	567,068	.....	8.9	3,084	2,834	250	8.9	8.9	
Total, 2																



PUBLISHED EVERY FRIDAY,  
At 73 Broadway, New York.

EDITORIAL ANNOUNCEMENTS.

**Passes.**—All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.

**Contributions.**—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particularly as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

**Advertisements.**—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN OPINIONS, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

THE BRAKE PRESSURE DIAGRAMS.

For many of the more important points to be considered in comparing power brakes such diagrams as appear in this issue, which simply indicate how the brake acts, and do not pretend to give evidence as to its actual effect in making quick stops, are far more useful than the latter. In fact the comparative length of stops, although a useful and natural test, is comparatively a crude one. The wheels of one train may be greasy, as actually happened in the first run of the Westinghouse. The brake-shoes of one train may be rough and fit the wheels badly, as also actually happened at Burlington with every train but the Westinghouse, giving the latter an unquestionably great advantage, although how great it would be impossible to say. The brake pressure may be unequal on the wheels, making the pressure on some of them needlessly small, unless it is dangerously large on others, as was the case with three out of the five trains tested at Burlington. The details of the apparatus may be badly designed, or it may be badly handled, so that the pressure is only 60 lbs. when it should be 70, or the area that the pressure acts on too small. That this actually happened to some extent with all the brakes tested is clear from what appears in this issue.

But just as it can be said from an indicator diagram, and only from that, whether or not an engine is working properly, regardless of the power developed, so there is a form to such diagrams as we give this week which would assure that, whether a brake as actually handled made good stops or not, it was potentially a perfect brake. There is no such danger of being misled as in comparing notes of the stops alone. Many of the buffer brake stops, for example, compare very favorably with those made with the air brakes, and it is only by going behind these returns and considering not only what they did, but how they did it that we can reach safe conclusions.

A perfect diagram of brake pressure should have, it is plain, this form :



The brake pressure should begin to go on at A at the very instant the brakes are applied; it should attain the full pressure at B as quickly as is consistent with avoiding shock to the train and brake gear; it should hold its pressure to the end of the stop at C, and drop off promptly when the brakes are released to D.

Whatever the actual pressure C D which the diagram indicates, a brake which gives a diagram of this form is functionally perfect, for we have only to increase our leverage or our pressure or both to make C D as great as is desired. We are then positively assured of doing every bit of work possible with the brake-shoes, which means making the quickest possible stop.

It will be seen that both the air brakes approximate

very closely to this ideal form of diagram, except in two important respects; so important, in fact, that we are quite justified in saying that no one of the brakes tested is in as good condition for practical work as it ought to be, or as the railroad public may reasonably expect. The brakes take an unconscionably long time before they begin to go on, especially with long trains, and after they begin to go on they take almost as unreasonably long a time before they are on with full force. That they go on gradually, is an immense advantage; that they go on so gradually, is a dead loss of efficiency. It does not even materially diminish the shock, for the shock results, beyond all question, from the irregularity in time of the application of the brakes on different parts of the train, and not from their quickness or slowness of application. The indications are, moreover, that by eliminating all surplus slack the shock will be reduced to very small proportions.

The difference in absolute pressure shown by the two leading competitors is not great in proportion to the load on the wheels, and it would be absurd to concede any inherent superiority to either on that account alone; but it is a discouraging fact that, with every inducement to enter these tests in the best possible condition for efficient work, neither one of the competitors managed to do so. Each of them succeeded in producing about two-thirds only of the pressure which was available to them without slipping the wheels. An apparent reason for this is not far to seek. Had the pressure carried in the train-pipe and auxiliary reservoirs been closely approached in the brake cylinders or diaphragms, the brake pressure would have approached closely to the load on the wheels, and so have been as high as safety warranted; but only about two-thirds of the reservoir pressure was, as a rule, and as an average of many tests, attained in the brake cylinders, and accordingly only about two-thirds of the available weight was utilized for braking purposes.

Only two explanations of this fact are possible: Either the competitors had not studied the workings of their apparatus carefully enough to be aware of this probable loss of efficiency, or they knew it was liable to work irregularly, and did not know how or did not feel obliged to take the trouble to remedy the irregularity. For if the difference of pressure were a part of the eternal order of things, it would be easy enough to correct it in the proportions of the parts. That there was no great irregularity in the workings of the apparatus on the different cars is evident from the notes of the stops, which show a pretty uniform level of low efficiency as compared with other performances on record, as we have said before and shall show more fully shortly.

What may be the best and safest remedy for these difficulties is something which we should not care to speculate on, nor must we be understood to assert that more than a partial remedy is possible at a cost which railroad companies can afford to pay. Some improvement is almost certainly possible, and it is sufficient for the present to point out that the action of the brakes is far from perfect. In the Westinghouse brake especially the admission of air to the brake cylinders seems to be objectionably slow.

We have plain evidence in the diagrams as to why the brakes on the rear half of 50-car trains gave little or no additional braking power; but it should not be assumed, therefore, that the brakes on the rear 20 cars were useless. As a safeguard against the breaking in two of trains, the tests showed that they were entirely efficient, and if they gave little additional power they at least did not impede in any way the working of the apparatus. The brakes released easily and certainly, and no difficulty was found in keeping up the supply of air for the extra cars. If some electrical or other device could be found, which would open the triple valves on any train, however long, at the same instant of time, undoubtedly the efficiency of the brakes and the usefulness of having them on every car would be vastly increased. In the meantime, the worst which can be said is that the brakes on every car of long trains do some good and no harm.

The indications of the diagrams of the American brake are certainly most decisive and explicit. It should be said, in explanation of the choice of diagrams for engraving, that the 50-car runs of the American brake with all cars braked were without exception very unfavorable. Severe shocks and many breakages resulted, as will be seen by referring back to our reports of the tests. The 25-car tests, on the contrary, gave in the main very satisfactory results as respects the motion of the train, and even the 50-car tests with the rear 20 cars cut out showed very good results, the stops being good, as compared with the Westinghouse and the Eames, and the impacts rather more favorable than with the other brakes, as is evi-

denced by the following abstract of the impact record:

Impact record of 50 empty car trains, with the brakes on the 20 cars cut out, being the distance in inches that the impact gauge illustrated in the *Railroad Gazette* of July 30, 1886, moved in each stop :

Service stops :	Stop 1. Inches.	Stop 2. Inches.	Stop 3. Inches.	Stop 4. Inches.
American.....	11	16 $\frac{1}{2}$	13 $\frac{1}{2}$	13 $\frac{1}{2}$
Westinghouse.....	none	8	7 $\frac{1}{4}$	6
Eames.....	37 $\frac{1}{2}$ , 2, $\frac{1}{2}$	27 $\frac{1}{2}$	15 $\frac{1}{2}$	35 $\frac{1}{2}$ , 1 $\frac{1}{2}$
Emergency stops :				
American.....	20 $\frac{1}{2}$	29 $\frac{1}{2}$	28 $\frac{1}{2}$	37 $\frac{1}{2}$
Westinghouse.....	17 $\frac{1}{2}$	9 $\frac{1}{2}$	18 $\frac{1}{2}$	8 $\frac{1}{2}$
Eames.....	49 $\frac{1}{2}$ , 7 $\frac{1}{4}$	51 $\frac{1}{2}$	24 $\frac{1}{2}$	45 $\frac{1}{2}$

and the fourth, tenth and thirteenth cars from the rear were derailed, causing suspension of the run.

We do not reproduce the stop records, but they compared fairly well. The diagrams therefore represent what was on the whole the best showing made by the American brake, and we only need to examine them to see how different is the story they tell from the mere record of the stops and impacts.

In the first place, there is the extraordinary suddenness with which the brakes are applied. Whenever the impact comes against the buffers the brake pressure rises up in an almost vertical line. Such impact strains are incontestably far more trying to the mechanism than much higher strains quietly applied, and it needs no great foresight to see that frequent breakages would be almost unavoidable.

In the next place, there is the extraordinary variation in the amount of brake-pressure developed. This is perhaps the most striking and ominous fact shown. With twenty unbraked cars behind, the brake-pressure on the twenty-fifth car from the rear rises to some unknown magnitude which certainly exceeds by more than 100 per cent. the allowable pressure and frequently recurs during a long stop, whereas with only a 25-car train the brake pressure after the first impact is considerably below what would be desirable. These contrasts indicate that the brake pressure is incapable of even an approach to exact graduation. Sometimes it is far above the allowable limits and sometimes as far below it.

In the third place there is the tendency to an enormous excess of pressure when the first impact comes which puts on the brakes. It is but natural that this should be so. The cars come together with a blow, and a blow is capable of producing for the time being almost any amount of pressure, as is evidenced from the fact that a 10-lb. sledge will drive a spike that it would take some tons of dead pressure to start into the wood. The surprising thing is, therefore, not that the pressure rises so high, but that it does not rise higher and that it stays on so long.

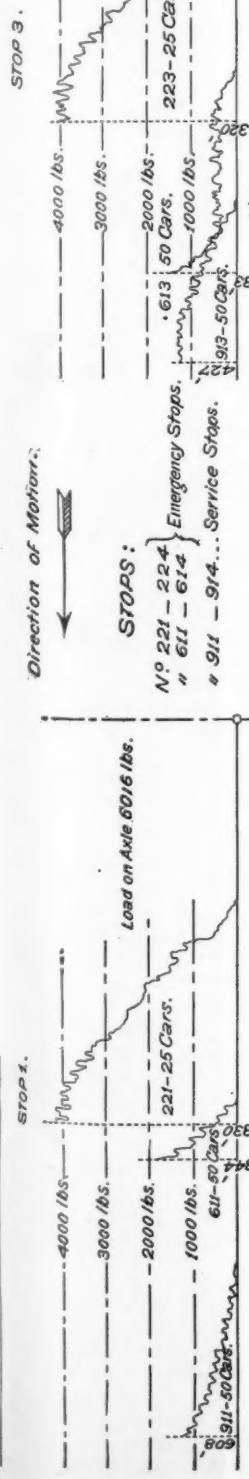
In the fourth place, but certainly not the least important, there is the way in which the brakes go on and off, several times during a stop, producing rapid alterations of very great pressure and no pressure at all. That any mechanism could stand such alterations as are shown in diagrams No. 3, which occurred under conditions likely constantly to recur in practice, will not, we think, be believed.

As the American brake made by far the best showing of any buffer brake which entered the tests, and as the details of its apparatus had plainly been worked out with great care and skill, this points directly to the conclusion that the buffer brake principle, as it was embodied in the devices presented for trial, is incapable of practical use on a large scale, and we perceive no reason why this is not a fair conclusion.

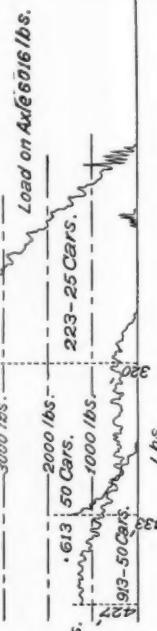
That there are conditions under which the American brake, at least, does very fair work safely and well must certainly be admitted. That it would crowd all competitors hard if it could do as good work under all conditions as it can do under some conditions can hardly be denied. That it will never be possible to make a buffer brake of any kind which will answer practical requirements, we should certainly be reluctant to assert, but that a buffer brake, to be permanently successful, must be so different in its details from the devices tested at Burlington as to be practically a different kind of brake was, we think, universally felt by those disinterested persons who took part in the tests.

The sole hope for a generally useful buffer brake seems to lie in this: 1, in only using so much of the great initial pressure as is admissible without sliding the wheels; 2, in holding that pressure throughout the stop in some positive way, regardless of whether the draw-bars are compressed or not; 3, in some efficient device for releasing promptly under these conditions; 4, in some efficient device (perhaps a small spring is all-sufficient) to prevent the sudden application of the brakes from causing breakage.

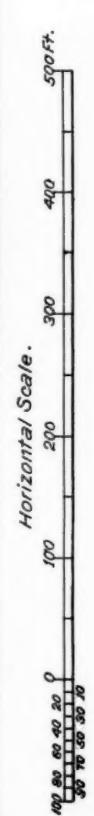
It certainly cannot be asserted with reason that the



N. B.—The horizontal scale of the first three sets of diagrams is slightly different, and of the last set largely different.



BURLINGTON FREIGHT TRAIN BRAKE TESTS.—SELECTED DIAGRAMS,  
Showing the Time, Manner and Force of the Application of Pressure to the  
Brake-Beams in Stops Made by the  
WESTINGHOUSE, EAMES VACUUM AND AMERICAN (BUFFER) BRAKES.



#### DIAGRAMS NO. 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 1.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for by the oscillations of the long brake-rods, and not to the working of the apparatus.

STOP 2.

STOP 3.

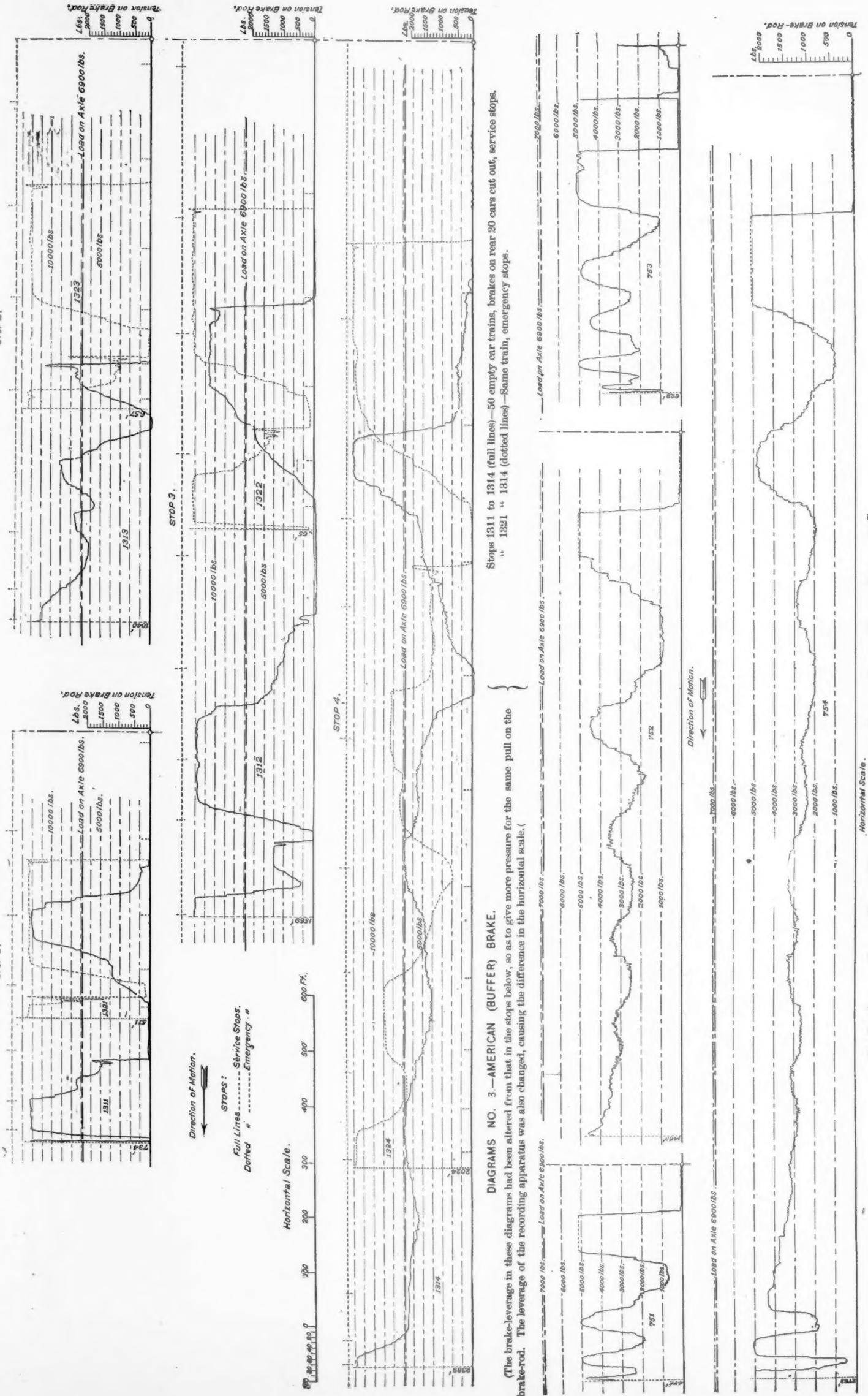
STOP 4.

STOP 1.—WESTINGHOUSE AUTOMATIC BRAKE.

(The serrated form of the diagrams is accounted for

(The dotted jump in the pressure line is accounted for as due to the inertia of the diaphragm, when the blow from taking up slack is received, and not to the working of the apparatus.)

STOP 4



DIAGRAMS NO. 3-AMERICAN (BUFFER) BRAKE.

The brake-leverage in these diagrams had been altered from that in the stops below, so as to give more pressure for the same pull on the brake-rod. The leverage of the recording apparatus was also changed, causing the difference in the horizontal scale. (

Stops 1311 to 1314 (full lines)—50 empty car trains, brakes on rear 20 cars cut out, service stops.

1321 " 1314 (dotted lines)—Same train, emergency stops.

DIAGRAMS NO. 4.—AMERICAN BRAKE.

fulfillment of any one or all of these conditions is *prima facie* impossible. All that can be said now is that it has not as yet been shown to be possible, and that buffer brakes in the only form in which they have been presented for trial have only succeeded in showing the absolute necessity of fulfilling them.

#### August Earnings.

Of the 38 railroads whose earnings are reported for August in this number, only one (the Detroit, Lansing & Northern) earned less than last year, and many had large gains—26 more than 10 per cent., and 14 more than 20 per cent. The aggregate of the 38 was :

	1886	1885.	Increase.	P. c.
Earnings . . .	\$18,323,488	\$15,861,016	\$2,463,372	15.5

This is an enormous gain, but earnings were very light last year on many of the railroads. The 86 roads in our table last year earned 6½ per cent. less total and 10 per cent. less per mile than in the corresponding month of 1884, which was itself an unfavorable month, the earnings per mile of the roads reporting then being 12½ per cent. less than in 1883. After two years of such larger declines, a considerable increase is necessary to make fair earnings. And the decrease was general, for out of 71 roads that had reported for a series of years, 54 earned less per mile in 1885 than in 1884, and 62 less than in 1883, and of 45 roads which had reported for six years, no less than 26 had smaller earnings per mile last year than in any other of the six. There was thus abundant room for the improvement which has occurred, as the reports below show, though many of them also show that large gains over last year have not made the earnings equal to those in some other years. We have given the earnings per mile with the total earnings in August for each of the last five years when possible :

	1882.	1883.	1884.	1885.	1886.
--	-------	-------	-------	-------	-------

*N. W. & St. Paul :*  
Can. Pac. .... \$264,790 \$591,000 \$365,815 \$802,000 \$925,348  
Per mile .... 335 314 226 287 260  
North. Pac. .... 727,215 1,043,624 1,032,602 971,289 1,172,225  
Per mile .... 559 542 421 361 422  
St. P., M. & M. 802,239 632,148 571,762 524,020 626,917  
Per mile .... 758 466 408 357 422  
St. P. & D. .... 134,518 140,567 126,253 128,526 144,493  
Per mile .... 534 669 558 571 642

*W. N. W. & S. W. of Chicago :*  
C. M. & St. P. 1,545,108 1,851,209 1,825,348 1,766,910 1,973,000  
Per mile .... 355 407 380 358 400  
C. & N. W. .... 2,311,622 2,403,459 2,027,982 1,922,235 2,317,800  
Per mile .... 665 668 539 500 587  
C. St. P., M. & O. 422,718 485,020 469,130 476,229 496,000  
Per mile .... 406 423 361 361 355  
Cen. Pac. .... 105,767 129,065 124,231 113,565 115,094  
Per mile .... 336 300 240 232 225  
III. C. in Iowa 160,531 168,472 129,480 120,349 150,479  
Per mile .... 399 414 322 299 397  
M. L. S. & W. .... 75,170 100,585 96,031 134,221 250,304  
Per mile .... 261 309 246 268 469  
Chic. & Alton. 856,398 886,556 859,902 724,346 748,325  
Per mile .... 1,008 1,043 1,012 852 881  
St. J. & G. L. .... . . . . . 98,923 63,428 73,887  
Per mile .... . . . . . 392 241 293  
D. & R. G. .... 578,443 699,603 476,356 562,733 614,630  
Per mile .... 507 405 362 427 467  
St. L. & S. F. .... 394,907 376,396 433,428 368,445 455,761  
Per mile .... 578 493 560 447 523

*North of the Ohio :*  
Ill. Cen. in Ill. .... 686,844 645,155 564,833 576,090 682,934  
Per mile .... 747 695 593 575 696  
Chic. & E. Ill. .... 170,300 158,061 150,514 146,736 165,968  
Per mile .... 597 627 597 582 659  
C. I. St. L. & C. 237,490 246,517 244,221 206,850 236,836  
Per mile .... 609 621 713 692 692  
Wabash .... 1,772,544 1,779,849 1,427,537 1,029,404 1,217,768  
Per mile .... 504 506 402 481 509  
L. B. & W. .... 292,177 319,713 298,851 242,800 257,531  
Per mile .... 401 460 430 456 483  
Ohio & Miss. .... 443,824 470,443 353,709 344,938 390,435  
Per mile .... 721 789 575 560 694  
O. South. .... 33,483 40,157 42,007 39,042 46,354  
Per mile .... 243 291 323 300 357  
C. & St. L. .... 125,722 151,286 127,266 113,570 117,945  
Per mile .... 310 369 310 275 281  
Det. L. & N. .... 134,659 152,348 116,801 110,200 110,979  
Per mile .... 596 586 448 422 387

*East :*  
Buff. N. Y. & P. 232,736 265,000 ..... 228,900 237,700  
Per mile .... 375 427 345 389  
Buff. R. & P. .... 66,609 112,541 110,084 136,301  
Per mile .... 300 383 374 464  
Grand Trunk. 1,310,858 1,491,593 1,385,525 1,153,312 1,397,670  
Per mile .... 590 643 475 395 479  
Long Is-land.... 257,916 391,007 389,258 380,904 404,798  
Per mile .... 1,011 1,113 1,100 1,076 1,144

*South :*

Ill. Cen. S. Div. 230,585 281,883 272,610 264,703 284,939  
Per mile .... 409 488 472 372 401  
Louis. & Nash. 1,043,912 1,251,127 1,116,312 1,076,681 1,190,535  
Per mile .... 515 606 541 531 591  
Norfolk & W. .... 222,160 261,711 228,408 196,089 252,322  
Per mile .... 519 520 454 386 495

Northwest of St. Paul the Northern Pacific's gain of 20½ per cent. over last year is somewhat surprising, for the harvest prospects in Dakota were not such as to stimulate traffic, and the probability is that it is a development of traffic on other parts of the system that made the gain of 10 per cent. in July and 20½ in August.

The Canadian Pacific is a through line to the Pacific now, and works 730 miles more road than last year. Its increase in earnings is very small compared with the increase in mileage, but on the other hand materials for construction probably yielded a considerable part of its earnings last year. Its earnings per mile are very much lighter than those of the Northern Pacific in its early days. The St. Paul & Duluth earned more than ever before in August, reflecting the growth of the two cities at its southern end and of shipments via Lake Superior. The Manitoba has a gain of 19½ per cent. over last year and also a gain

over 1884, while until July its earnings this year were the smallest since 1881.

The great railroads northwest of Chicago have large gains over last year, but not over some previous years. The Milwaukee & St. Paul's gain over last year is \$206,000 (11½ per cent.), but it is but \$121,800 (6½ per cent.) over 1883, the length of road having increased more than 300 miles meanwhile. The Chicago & Northwestern earned 20½ per cent. more than last year, but not as much as in 1883, when it had 330 miles less road. The St. Paul & Omaha, with a gain of 4 per cent. over last year, earned less per mile than in any other year since 1880. The crops on these lines are generally not very good this year, not as good as last year—and though the movement of these crops could not have become very important in August, their condition is likely to have an important effect on other traffic, even before they are harvested. This being so, the large gain in earnings over last year indicates that in industries other than agricultural in this territory were much more active than last year—as we know the mining and shipping of iron ore, which affords an important traffic to the Northwestern, to have been. The Iowa lines of the Illinois Central earned much more than in 1885 and 1884, but not so much as in 1882 and 1883.

Further south the Chicago & Alton earned 3½ per cent. more than last year, but about one-eighth less than in any of the three years previous; but the St. Louis & San Francisco earned 26 per cent. more than last year and more than ever before. It has been increasing its mileage, however, and its earnings per mile, 17 per cent. more than last year, were less than in 1884 or 1882. The Denver & Rio Grande, which has a field of its own, earned more than ever before, except when it included the Denver, Rio Grande & Western. The Illinois lines of the Illinois Central gained 15 per cent. over last year and 17 per cent. over 1884, but earned less than in 1882, and its Southern Division earned more than ever before, but on by a trifle more than in 1883, when it had a fifth less road.

North of the Ohio the Wabash gains 18 per cent over last year. Its earnings in the other three years in the table were from more than 3,500 miles of road, against 2,100 now and last year. The Eastern Illinois has not earned so much since 1880, its gain over last year being 18 per cent. The Chicago & Atlantic earned 42½ per cent. more than last year, and had the considerable earnings of \$526 per mile; the Ohio & Mississippi more than in 1884 and 1885, but less than in 1882 and 1883.

The Cincinnati, Indianapolis, St. Louis & Chicago, which carries a little through traffic on its way to the East, but more to the South, though it gained 14½ per cent. over last year, still earned less than in any of the three years previous.

In the East the Grand Trunk earned 21 per cent. more than last year, but nearly the same as in 1884 and 6 per cent. less than in 1885, and the Long Island earned more than ever before.

This is a very satisfactory report.

#### The Proportioning of Culverts.

It is natural for fallible man to wish to reduce everything to rule, even if it be only a rule of thumb. The responsibility of the individual is much diminished if he have something of that kind to lean on, and in so doubtful a matter as the proper size of culverts this is especially natural. It is well, however, to be certain that we are not simply making a rule where there is no rule, and so laying the foundation of future trouble, and we must confess to doubts as to whether this is not the case with the various formulae for proportioning the water-way of culverts, of which that given by our correspondent in another column is one of the most approved and the best known.

It is but just to premise that some evidence of value that the formula is deemed trustworthy has recently come to our hand in the form of a table prepared by the Chicago, Burlington & Quincy Railroad for the putting in of iron pipe culverts. In fact, the table is palpably prepared from Major Myers' formula unless there is a very extraordinary coincidence, for taking  $c = 1$  in the formula  $A = c \sqrt{M}$ , as Major Myers proposes for flat agricultural country, we have the following :

Draining up to	Size of Culverts.	Proper Size by Maj. Myers' formula.
15 acres.	2 ft.	2.14 $\sqrt{15} = 3.87$
25 "	2 ft. 6 in.	4.31 $\sqrt{25} = 5.00$
50 "	3 ft.	7.07 $\sqrt{50} = 7.74$
90 "	3 ft. 6 in.	9.62 $\sqrt{90} = 9.49$
150 "	4 ft.	12.57 $\sqrt{150} = 12.95$

These proportions are practically identical with those given by the formula, but it is reasonable to suppose that on a road like the Burlington they would not have been adopted unless comparison with a greater or less number of actual examples had shown that they were about what was required.

Nevertheless, as a guide for practical work we must confess that we have always regarded this formula with some suspicion, for the reason, if there were no other, that it is after all nothing more than a more learned way of guessing at it. The area drained will be ordinarily the first thing guessed at, for it is not ordinarily surveyed, and the liberal range granted between the constants "1" (for flat country) and "4" (for mountainous country) merely amounts to saying in words that "to drain an area of — acres, the culvert should be from 6 to 15 ft. span, according to the nature of the country," which brings down the assistance rendered by the formula proper to pretty small dimensions. Moreover, it is not true that, so far as experiment can be said to have determined it, the amount of water delivered per second under otherwise similar conditions is as the square root of the area drained. It is probable that it is quite beyond the reach of exact formula to express it for more than one locality, but the usual rule for proportioning sewers, if we are not mistaken, is that the delivery per

area second at the entrance to the sewer will be as  $\sqrt{\text{area}}$  rather than as  $\sqrt{\text{area}}$ . This would give us, starting from the small drainage area of 10 acres as a unit :

For an area of 10 acres	A comparative delivery of water per second of culvert	Whereas the formula makes the comparative area of culvert
100 "	1.00	1.00
1,000 "	5.63	3.16
10,000 "	31.62	10.00
100,000 "	177.80	31.62

There is to be considered, it is true, the larger discharge of large culverts per square foot of area, but this is not very great, after the smallest sizes have been exceeded, and it would not be proper to assume any difference in head or slope of culvert.

Again, the conditions as respects rain-fall are alike in no two localities. Very great differences exist within a few miles of each other. A still more important question is this: There is, unquestionably, in drainage, as with a pendulum, what may be called an *isochronous curve* to topography, so that in some cases, whether the water falls near to or far from the culvert within the limits of its drainage area, it will reach it about the same time, the greater distance the water has to travel being made up to it by the greater rapidity with which it begins to travel, owing to the steeper slope of the ground. A continuously concave or spoon-shaped profile, including the entire basin, obviously approaches closely to this condition, and is not at all uncommon. In such cases, the form of the drainage area obviously has vastly more to do with the sufficiency of a culvert than its size.

An example on an enormous scale of the effect of such topographical conditions was afforded in the location of the Mexican Central Railway. The line of that road runs for a long distance through the heart of an open and broad valley, which is to all appearance level where the road lies, but which, in fact, slopes off gently on one side from three to twenty miles to the river which drains the basin, and on the other side rises as gently for an equal distance to the foot-hill of a sharply-defined and quite extensive mountainous area, half of which likewise drains into the basin. Nothing more innocent and mild can be conceived of than the whole appearance of this "flat" along the line, and even of most of the streams which crossed it. The soil was black and rich, and the few streams had light sandy bottoms, with no evidence of very great wash.

When the line was all built and it began to be tested by the heavier rain-falls, the meaning of the situation was better appreciated. Had the country been all plain or all mountain, no difficulty would probably have arisen, but, as it was, the peculiar and unusual topography had the effect of delivering the water in great sheets and all at once, without any particular regard to where the nominal waterways were situated. The flat plains along the track held back the water falling near to it and prevented its prompt delivery. The steep slopes miles away started the water along promptly, and the more promptly the farther it fell. The effect was that the capacity of the water-ways was vastly exceeded and the track washed out in the most unaccountable way at the most unaccountable places. Except for the obstruction of the track, large areas would have been temporarily under water, but with so slight a fall to the water that no great velocity was possible, no great harm could be done. Consequently, there was no in-

dition on the face of the country that these conditions obtained at times of great rain-fall.

This thing on a smaller scale takes place in many localities, as does also the reverse. If the drainage area has a nearly uniform slope, or if it slopes quickly near the culvert and more gently away from it, a very much less area of water-way will suffice for the same area than if it be spoon-shaped, for in almost every storm—in every one, in fact, which is a serious trial to a culvert—there are a few moments of maximum rain-fall when the mischief is done, if any is done.

When in addition the probable variations in maximum rain-fall and possible future changes in the condition of the surfaces are considered, we cannot but regard the proportioning of culverts to a formula as entirely futile. Even in the much simpler, because more regular and determinable, problem of proportioning the size of city sewers, many engineers claim that safety can only be assured by comparison with experience with as many similarly situated sewers as possible and then taking care not to overload the sewer after it is built; and with much reason. For culverts, if we were called upon to suggest a formula, we could do no better than this: Estimate the necessary area as carefully as possible by existing evidences of maximum flow, which let  $A$ . Then will  $\sqrt{A}$  = the proper area for the culvert. In more popular language: Guess at the proper size and double it. We apprehend that this formula will give far more satisfactory and trustworthy results than that which our correspondent quotes, or any other which purports to be of general application to a problem subject to such extremely diverse conditions.

If the practice of omitting a dead-lever from the truck brake-gear should be discredited and discouraged by the results of the Burlington brake tests, perhaps that alone would be an ample return for the cost of making them, to the whole railroad system, although not to the Chicago, Burlington & Quincy, which bore the whole cost of the tests and is not guilty of such bad practice. That the brake pressure should be deliberately reduced to three-fourths of its proper amount on half the wheels of a train simply for the lack of a bar of iron weighing perhaps, with all its attachments, 50 lbs., would seem incredible if it were not known to be so common. A chief reason for this practice, we may fairly assume, is that the extent of the loss is not fully appreciated. In fact, very many men no doubt have a vague idea that the brake-lever has a "pry" on each brake-beam, which for all practical purposes gives the same pressure on each beam whether there is a dead lever or not.

This is far from the case, and the rule for the loss of pressure by not putting in a dead-lever is so simple and easily remembered as to be worth giving:

With a brake leverage of 1 to 4 (4 being the total length of the brake-lever), which is the most common proportion, the pressure on the "off" brake-beam (that to which the brake-rod is directly attached) is only three-fourths of that on the other brake-beam: with a brake leverage of 5 to 1 the pressure is four-fifths; with a brake leverage of 3 to 1, two-thirds, etc., etc.

This loss, it should be remembered, is without any shadow of compensation in the power required to put on brakes. Perhaps it might be necessary to give the brake-wheel an extra fraction of a turn, but this extra work would be only the taking up a little more slack. The hard part of the brakeman's work, putting the proper pressure on the brake, is not increased or affected in the slightest.

The managers of the railroads from Chicago westward, northwestward and southwestward have been for some time engaged in negotiations of very great importance, the object being to make an agreement for the division of the through business, both passenger and freight, or the earnings from it, in each of the three districts which have been included in the Southwestern and Northwestern and the Iowa Trunk Lines associations, and the corresponding passenger associations. These negotiations are in pursuance of the agreements made last June, when for a few days the rates west and northwest were in a very demoralized condition. The earnestness with which they are pursued makes it probable that something will be effected, but the opening of the Wisconsin Central and the Chicago, Burlington & Northern to St. Paul and Minneapolis gives two additional lines to deal with in that quarter, and lines which have not had time to make a record as to their ability to secure traffic. It seems, however, that they are anxious to co-operate with the other roads, and where there is a will there is pretty sure to be found a way, in this as in other affairs

though in this it is necessary that all the numerous parties should have the will.

#### Bridging the Hudson.

There is again much talk of a bridge over the Hudson, and not of one only, but of three. This, however, is natural. The people who have control of one of the companies organized to build such bridges may be content to bide their time, so long as the others are doing nothing, but so soon as one talks of building, all the others are likely to. Should one be built, or begun, under circumstances making it probable that it would be completed, it would be impossible to get capital for another, and the bare talk of building by one company makes it more difficult for another to get money.

Judging by the map, it seems strange that there should be no bridge over the Hudson south of Albany, so that the greater part of the manufacturing country of New England is made virtually a peninsula by that great river, which cuts it off from the great western territory where most of its manufacturers are marketed. It is not so strange as the map makes it seem, however. Owing to the mountainous country west of the Hudson south of Albany, the railroad lines to the west nearly all begin either at New York or Albany, and even with a bridge at Cornwall or Poughkeepsie, the course of traffic would be southwest before going west or northwest on its way to the Western market, and from few New England towns would it be shorter than by way of Albany or New York. Moreover, the hills east of the Hudson, though not very high, make bad gradients for the railroads, and those reaching the Hudson north of New York and south of Albany can only take small trains between the Hudson and the Connecticut Valley, as the New York & New England found when it carried a large through traffic by way of Newburg. At the latter place the transfers across the Hudson may still fairly be called important, and at Rondout the Delaware & Hudson sends a great deal of coal across, though as the coal arrives by canal, it can be delivered on one side of the river about as well as on the other. The existence of this source of coal supply from the anthracite mines where they are nearest the Hudson gives that part of New England south of the Boston & Albany and north of the Sound about as *short* a route as possible.

Whether this coal traffic and the through New England freight going by the lines which could use a bridge would pay interest on the necessarily great cost of such a structure is a question that cannot be discussed profitably without more definite statistical data than we possess. It is hardly necessary to discuss it, however, until we know whether the lines which control the traffic would send it over the bridge if it were built. Since the days of J. Edgar Thomson, who took an interest in the Poughkeepsie project when first organized, none of these companies, so far as we know, has shown any desire to have a bridge built, and they better than any one else know how much it would be worth. It is safe to say, however, that no one bridge would get *all* the traffic. The Delaware & Hudson would not send its coal around by way of Cornwall, nor the Erie its by way of Poughkeepsie, and the Pennsylvania could not afford to abandon the New Haven line for an inland line, and would probably do better to send all by one line than divert a small part to a middle Hudson crossing. If the Pennsylvania, the Erie, the Lackawanna and the Delaware & Hudson would unite to send their New England traffic across a bridge, the prospects of one would be very different from what they are.

A bridge which would interfere with navigation would be more objectionable on the Hudson, probably, than on any other river in the world, the traffic on it being enormous and very largely conducted in great tows of scores of canal boats which form veritable floating islands, and need a great deal of water way.

#### Atchison, Topeka & Santa Fe Earnings in July.

The Atchison, Topeka & Santa Fe Railroad has a large gain in earnings in July, which was hardly to be expected, as Kansas had a light wheat crop, and the transcontinental traffic was carried at extremely low rates. But the comparison with July last year is with a month of exceptionally light earnings, and the company's earnings and expenses in July for six years have been:

Year.	Miles.	Gross earn.	Expenses.	Net earn.
1881	1,377	\$1,000,610	\$694,499	\$306,141
1882	1,820	1,251,662	637,983	613,690
1883	2,219	1,325,710	557,707	768,003
1884	2,239	1,301,639	817,866	483,773
1885	2,397	1,181,784	646,711	535,073
1886	2,418	1,303,110	643,561	659,759

Thus, while the gross earnings this year were 10 per cent. more than last year, they were nearly the same as in 1884, and less than in 1883. The net earnings this year, however, were exceeded only in 1883, and are 23½ per cent. more than last year.

For the seven months ending with July the earnings and expenses have been:

Year.	Gross earn.	Expenses.	Net earn.
1882	\$8,557,479	\$5,389,238	\$3,168,241
1883	8,694,704	4,196,024	4,498,680
1884	8,948,452	4,928,739	4,019,713
1885	8,409,040	5,759,039	3,650,001
1886	8,244,478	4,641,952	3,602,516

Thus the gross earnings were less this year than in any other of the five, and the net earnings were the smallest since 1882, when they were made small by extraordinarily large expenses. Compared with last year the decreases have been:

Year.	Gross earn.	Expenses.	Net earn.
Amount	\$164,582	\$17,087	\$47,475
Per cent.	2.0	2.5	1.3

These are very small changes, but the net earnings this year were 10 per cent. less than in 1884 and 20 per cent. less than in 1883. It should be remembered that Kansas was exceptionally fortunate with its crops until last year, when

there was a bad wheat crop, on which the July traffic depends to a considerable extent, while this year not only is wheat a light, but corn will be a much lighter crop than for several years previous. Meanwhile a great deal of new road is being built which by next year will divide the traffic with the old lines, but is now giving some of them a considerable traffic.

#### Chicago, Burlington & Quincy Earnings in July.

Like most railroads that have reported for July, this company shows a very large gain over last year in both gross and net earnings, greater, perhaps, than that of any other important railroad outside of the territory affected by trunk line rates, and the gain is the more remarkable because it is not likely to have profited much by the heavy winter wheat movement, for the winter wheat which it carries comes mostly from Kansas, and Kansas had a light crop last year.

The mileage, gross and net earnings and working expenses of the road in July for seven successive years have been:

Year.	Miles.	Gross earnings.	Expenses.	Net earnings.
1880	2,597	\$1,773,643	\$749,393	\$1,024,250
1881	2,712	1,888,458	942,495	945,863
1882	3,168	1,625,006	873,820	751,186
1883	3,223	1,824,705	1,039,751	784,955
1884	3,359	1,735,199	1,092,405	642,784
1885	3,501	1,812,834	1,117,857	694,977
1886	3,700	2,330,741	1,161,787	1,168,954

Thus gross and net earnings and expenses all were larger this year than ever before, though it is noticeable that the net were but \$144,704 more than in 1880, in spite of an increase in gross of \$557,098 since then. The increases over last year are:

Amount	Gross earn.	Expenses.	Net earn.
Per cent.	\$517,907	\$43,928	\$478,970

A gain of 69 per cent. in net earnings is very important. Of itself it is equal to 63 cents per share of the company's stock.

This, however, is the first month of this year in which there has been any gain in net earnings, and for the seven months ending with July the company's earnings and expenses have been:

Year.	Gross earnings.	Expenses.	Net earnings.
1880	\$11,433,243	\$5,397,117	\$5,036,131
1881	10,986,905	5,483,098	5,103,807
1882	10,781,121	6,139,423	4,641,698
1883	13,229,908	7,063,497	6,166,501
1884	13,351,220	7,549,450	5,801,764
1885	14,185,802	8,335,180	5,850,622
1886	13,854,100	7,841,013	6,013,087

Thus the gross earnings for the seven months were larger than in any previous year, while the net earnings were exceeded in 1880 and 1883. Compared with last year the changes are:

Amount	Gross earn.	Expenses.	Net earn.
Per cent.	Dec. \$31,702	Dec. \$491,167	Inc. \$162,465

Thus the continuous losses in net earnings of the first six months of the year, amounting to \$316,514, were wiped out in a single month, and transformed into a gain of half that amount.

It is common for the earnings of this railroad to be much larger in August than in July, but in most years heretofore they have been less in July than in June. The large earnings last July may indicate an earlier trade movement than usual, and if so the earnings cannot be expected to be as much larger in August than in July as they usually are. They were \$670,000 larger in 1883, \$712,000 in 1884, and \$412,000 last year. The maximum earnings are usually in September or October.

#### Union Pacific Earnings in July.

The Union Pacific does not show the improvement in July earnings which many railroads report, which, perhaps, is not to be wondered at considering the very low transcontinental rates. Its gross and net earnings and working expenses in July for seven years have been:

Year.	Miles.	Gross earn.	Expenses.	Net earn.
1880	2,706	\$2,151,248	\$855,537	\$1,295,711
1881	3,125	2,703,092	1,377,410	1,325,502
1882	3,633	2,157,969	1,156,536	1,001,421
1883	4,121	2,491,035	1,284,998	1,206,037
1884	4,340	2,375,869	1,134,830	1,241,069
1885	4,500	2,304,980	1,216,837	1,088,153
1886	4,519	2,442,058	1,376,090	1,065,559

Compared with last year there is an increase of \$137,068 (6 per cent.) in gross earnings, but the increase of \$159,862 (13 per cent.) in working expenses caused a decrease of \$22,794 (2.1 per cent.) in net earnings. Still these latter compare much more favorably with the net earnings of the earlier years than they did in June.

For the seven months ending with July the earnings and expenses have been:

Year.	Gross earn.	Expenses.	Net earn.
1880	\$13,608,501	\$6,533,440	\$7,075,061
1881	15,239,582	8,670,129	6,569,433
1882	15,554,053	8,591,688	6,933,477
1883	15,460,758	8,128,668	7,332,090
1884	13,369,716	8,768,924	4,600,792
1885	13,529,520	8,714,318	4,815,202
1886	14,048,146	9,321,405	4,726,741

As in the case of the July earnings, the gross earnings for the seven months were the largest for three years, but the expenses have increased so much that the net earnings were a little less than last year, compared with which there is this year an increase of \$518,626 (3.8 per cent.) in gross earnings of \$607,087 (7 per cent.) in working expenses, and so a decrease of \$88,461 (1.8 per cent.) in net earnings, which latter were \$2,606,349 (35½ per cent.) less than in 1883, notwithstanding an increase of 10 per cent. in mileage meanwhile. Nearly the whole change must be due to lower rates, and in spite of a large increase in traffic.

The agent of a great American firm in the Argentine Republic, in a communication to his firm regarding the *Railroad Gazette*, asks that we publish a paragraph warning ordinary American railroad employés against going to that country. "It is no place for them," he writes, "and there

is no employment here for them. I make this request because many come here, and after having made the long journey find nothing but disappointment."

We shall have to add a new cause of railroad accidents in our record. The earthquakes last week caused several, and there is, probably, none in the whole catalogue of which it can as truly be said that no body was to blame. Probably there have been railroad accidents before caused by earthquakes, but earthquake countries are not generally railroad countries, else there probably would have been some terrible casualties due to this cause, increasing the horrors which are already sufficiently great. When the solid earth undulates like the waves of the sea, no structures man can build will afford a safe path for railroad trains.

The condition of the cotton crop Aug. 24 is reported in *Bradsstreet's* by 1,182 correspondents in 597 out of the 650 counties in which more than 500 acres are planted. These show that the eastern cotton states, where until near the close of July the weather had been very unfavorable and the crop did not promise well, have had fair weather since and the crop has improved, while just the contrary is the case in the southwest, especially in Texas, where severe drought has done serious injury. The Carolinas and Florida promise better than last year, when their crop was light, and so do Tennessee and Arkansas, but other states promise less than last year, when only one of them, Texas, had a large yield. The Memphis Cotton Exchange reports, however, that in its district, including Arkansas, West Tennessee, North Mississippi and North Alabama, the prospect is favorable for about an average yield.

The total grain receipts at the eight reporting Northwestern markets were larger in the fourth week of August than in any previous week of this year, and have seldom been much exceeded in any year. For six weeks the Northwestern receipts have been in bushels (all grains, but not flour):

Week ending  
July 24. July 31. Aug. 7. Aug. 14. Aug. 21. Aug. 28.  
6,949,492 7,146,154 7,028,773 8,318,917 7,940,770 8,637,066

There was no week last year when these receipts reached 8,000,000 bushels even, and there was but one in 1884 when they were as large as in the fourth week of August this year, though there were five when they exceeded 8,000,000. In 1883 there were four weeks, in 1882 and 1881 none, and in 1880 five when these heaviest shipments of this year were exceeded. In most cases the very heavy receipts have been later in the season, when there were large receipts of spring wheat.

The shipments of grain from the Northwestern markets were larger in the fourth week of August than before this year, but the rail shipments remained quite moderate, and these consisted mostly of oats. The lake vessels evidently are doing all they can, and what between the ore and the grain pressing for shipment the rates have gone up to 5½ cents per bushel from Chicago to Buffalo, against 1½c. last year at this time. This cannot continue long without forcing large shipments upon the railroads, for thus only can the shipments be increased. The demand for ore vessels is imperative, for when navigation closes shipments must cease, while the grain can continue to go forward by rail. It will not be surprising if the railroads should have a large and profitable grain traffic through the fall and winter.

For four weeks ending Aug. 28 the Northwestern shipments have been:

Year.	By rail.	Down Miss.	By lake.	Total.
1881.	9,297,100	431,800	12,775,100	22,504,000
1882.	8,975,800	1,022,100	9,076,000	19,073,900
1883.	8,408,400	681,100	14,527,800	23,625,300
1884.	7,381,300	779,000	11,848,800	20,005,100
1885.	7,561,382	587,857	8,997,286	17,146,505
1886.	6,291,321	661,800	12,697,781	19,650,898

Thus the rail shipments were smaller this year than in any other of the six, while the lake shipments were exceeded only in 1883 and (very slightly) in 1881. While there is an increase over last year of 2,504,000 of total shipments, there is a decrease of 1,270,000 (16% per cent.) in the rail shipments, while the lake shipments have increased 3,700,000 (41 per cent.).

It was not to be expected that the rail shipments would be as large this year as in 1885, 1884 and 1881, when rail rates were lower, but it is not obvious why less should have gone by rail than in 1883, when rates were as high as this year. The percentage of the total grain shipments in August that have gone by rail has been:

1881.	1882.	1883.	1884.	1885.	1886.
41.3	47.0	35.6	36.8	44.1	32.0

Thus, the proportion of the total, as well as the quantity going by rail, was the smallest this year since 1880.

The lake flour shipments, which were so remarkably large this season until recently, have fallen off greatly. From the first of May until the middle of August there were but two weeks when they fell below 100,000 barrels; in the third and fourth weeks of August they were 79,847 and 77,553 barrels, respectively. It is true that the rail shipments have not increased, but they have been well maintained for the five weeks ending Aug. 28, in which they ranged from 91,152 to 96,972 barrels per week.

The change may be wholly due to more shipments from St. Louis and other places where winter wheat is ground, and less from Minneapolis, where spring wheat is ground, it being too early for the new crop of the latter to appear. It is only from Lake Superior that there is much advantage in shipping by lake, and anything that interrupts the Lake Superior shipments is likely to have a great effect on the total lake shipments.

The Northwestern wheat receipts, after having decreased every week from the last week of July to the third week of August, increased in the fourth week of August. The gain was evidently due to spring wheat, and it was chiefly at Du-

luth, which is having heavy receipts earlier than usual. Its receipts have been for five weeks:

July 31.	Aug. 7.	Aug. 14.	Aug. 21.	Aug. 28.
187,330	113,173	294,594	396,212	608,508

But there was some increase over the third week of August at Chicago and Milwaukee also. At Toledo and Detroit there was a considerable decrease, as for several weeks previous, but St. Louis gained after having lost for four weeks, and the receipts of these three winter wheat markets have been:

July 24.	July 31.	Aug. 7.	Aug. 14.	Aug. 21.	Aug. 28.
3,063,421	3,102,515	2,119,687	2,045,936	1,825,385	1,784,061

What is particularly noticeable in the receipts is that though the spring wheat which first ripens is nearly all grown on Chicago and Milwaukee railroad lines, Duluth already receives more than Chicago and Milwaukee together, the receipts in the fourth week of August having been 408,269 bushels at Chicago, 127,498 at Milwaukee, and 608,508 at Duluth. This leads to the suspicion that Duluth has been getting wheat from the country far south of it and directly west of Milwaukee and Chicago—that it has been diverting grain which has usually gone to Lake Michigan. This was prophesied of Duluth when it first set up as a port, but it was so long before its dealings were considerable with the country close at hand that most of us hardly expected that it would ever get much grain from Iowa, Dakota and Southern Minnesota, and very likely it never would but for the growth of a great lumber trade from the country near Lake Superior to the south and southwest, and the anxiety to get loads for the cars on their way back.

Of four railroads having a large mileage west of the Missouri that have reported gross and net earnings for July, all have gains in gross earnings. The percentage of increase in gross in July has been:

North. Pac.	Union Pac.	C. B. & Q.	Atch. T. & S. F.
10.0	6.0	28.6	10.3

In net earnings their percentage of increase or decrease in July was:

North. Pac.	Union Pacific.	C. B. & Q.	A. T. & S. F.
Dec. 2.7.	Dec. 2.1.	Inc. 69.0.	Inc. 23.3.

The Atchison and the Union Pacific together are the chief carriers for Kansas, the Union Pacific and the Burlington for Nebraska, but by far the larger part of the latter system is east of the Missouri.

For the seven months ending with July the percentages of increase and decrease of these companies have been:

A. T.	North. Pac.	Union Pac.	C. B. & Q.	& S. F.
Gross earnings.....	Inc. 8.6	Inc. 3.8	Dec. 2.3	Dec. 2.0
Net earnings.....	Inc. 9.5	Dec. 1.8	Dec. 2.8	Dec. 1.3

Only the Northern Pacific, which is in the newest country, shows any gain in net earnings for the seven months; those which gained most in July having lost most for the seven months ending with July, but the decreases of all three are very small.

#### Record of New Railroad Construction.

Information of the laying of track on new railroad lines is given in the current number of the *Railroad Gazette* as follows:

*Annapolis & Baltimore Short Line.*—Track laid from Annapolis, Md., to Carpenter's Hill, 8 miles.

*Atchison, Topeka & Santa Fe.*—A total of 64 miles is reported on the various branches of the *Chicago, Kansas & Western* lines.

*Augusta, Gibson & Sandersville.*—Extended from Gibson, Ga., south 10 miles.

*Chicago, Burlington & Quincy.*—The Fairmont Branch is extended from Strang, Neb., southwest to Superior, 18 miles.

*Chicago, Milwaukee & St. Paul.*—A branch is completed from Andover, Dak., north to Harlem, 55½ miles.

*Denver Railroad & Land Co.*—Road completed from Denver, Col., to Scranton, 17 miles.

*Detroit, Bay City & Alpena.*—Extended from Black River, Mich., north 16 miles.

*Eutawville.*—Extended from Eutawville, S. C., north to Vance's Ferry, 4 miles.

*Fremont, Elkhorn & Missouri Valley.*—Extended from Lusk, Wyo., west to Douglas, 48 miles. The Lincoln Branch is extended west to Wahoo, Neb., 16 miles.

*Kansas, Nebraska & Dakota.*—Extended from Laura, Kan., north to Paris, 25 miles.

*Litchfield & St. Louis.*—Completed from Litchfield, Ill., south to Mt. Olive, 8 miles.

*Midland of Indiana.*—Extended from Westfield, Ind., west to Eagletown, 5 miles.

*Minneapolis & Pacific.*—Track laid from Glenwood, Minn., west 24 miles, and from Fairmount, Dak., west 10 miles.

*Minnesota & Northwestern.*—The Dubuque & Northwest line of this company is extended southeast to Frederickburg, Ia., 30 miles.

*Ohio Valley.*—Extended from Morganfield, Ky., southwest to Dekoven, 11 miles.

*Pittsburgh & Western.*—Extended northeast to Ormsby, Pa., 4 miles.

*St. Louis, Fort Scott & Wichita.*—The Newton Branch is extended from Newton, Kan., northwest 12 miles.

*St. Louis & San Francisco.*—The Winfield Branch is extended from South Haven, Kan., west to Caldwell, 13 miles.

*St. Paul, Minneapolis & Manitoba.*—A branch is completed from near Tintah, Minn., west to Hankinson, Dak., 25½ miles. The St. Cloud & Willmar Branch is extended from Richmond, Minn., west by south to Willmar, 38 miles.

*Union Pacific.*—The Manhattan & Blue Valley line is extended from Randolph, Kan., north to Marysville, 16 miles.

This is a total of 476 miles on 90 lines, making in all 13,439

miles thus far reported for the current year. The new track reported to the corresponding date for 15 years has been:

Miles.	Miles.	Miles.			
1886.....	3,430	1881.....	4,235	1876.....	1,556
1885.....	1,627	1880.....	3,288	1875.....	746
1884.....	2,384	1879.....	1,863	1874.....	1,022
1883.....	3,584	1878.....	1,273	1873.....	2,507
1882.....	6,940	1877.....	1,223	1872.....	4,623

This statement covers main track only, second or other additional tracks and sidings not being counted.

#### NEW PUBLICATIONS.

*Hydraulics. The Flow of Water through Orifices, over Weirs and through Open Conduits and Pipes.* By Hamilton Smith, Jr., M. Am. Soc. C. E., New York; John Wiley & Sons.

It is not often nowadays that technical matter is presented so luxuriously as in this volume, with its 400 "beautiful quarto" pages, in which a neat rivulet of text meanders through a meadow of margin," but the author's or the publisher's choice is certainly entitled to be respected in this case, for although the volume is more than twice the size that it might have been made with perfect ease and yet present the matter rather luxuriously, yet as the book is (at least we take it to be such) by much the best and most recent treatise on its subject which is now in print in any language, those who have need for it will not begrudge the extra paper, and certainly not the large and clear type.

A large amount of exceptionally valuable work in hydraulics has been done in recent years by six or eight American engineers (among whom the author is not the least), which has done much to extend and complete our knowledge of the subject. In this volume all this work is presented, and likewise full abstracts of all that is best of French, German and English authorities, the whole collated, summarized and discussed in an admirably clear and thorough way.

We will add that the volume has the unusual and striking merit that the less any engineer has made a specialty of hydraulics the more useful he will find the volume in cases where he has to deal with questions touched by it. It is thorough without being pedantic, and will, doubtless, long continue to be a standard work, since the particular class of problems to which it relates have now been pretty thoroughly investigated.

#### TRADE CATALOGUES.

*Catalogue of Instruments for Drawing, Surveying, etc.*, manufactured by W. F. Stanley, London, England. This is the seventeenth edition of very complete catalogue of a great variety of instruments useful to engineers, surveyors, draughtsmen and photographers. The leading varieties of instruments are clearly shown by numerous engravings, which give particulars of many novelties and improvements, many of which are the invention of Mr. Stanley, who has probably done more to improve drawing instruments than any other one person.

*The Riley Elevated Railway System.* Riley Railway Construction Co., New York.

This very elaborately illustrated folio gives illustrations of the various methods of applying one of the many designs for a single rail elevated line of the inverted A type, the trucks being four wheel; two centre wheels, set tandem, to carry the load, and two side wheels, opposite the centre of the other two, to steady the vehicle. The design certainly possesses features of merit, and if it should be materialized into actual track will be studied by railroad men with interest. At present it would be premature to discuss it in detail.

#### Foreign Technical Notes.

An association of the several boiler inspection societies of Germany has had chemical analyses made of all the secret compositions offered for sale as specifics against boiler incrustation. The number reported so far is 32, and the association recommends that none of them be used. Some of these compositions were as follows:

At Berlin is offered "Albert's incrustation powder," composed of chalk, common caustic lime, slacked lime, potash Glauber's salts, a little sand, water and glue, with traces of other substances. It is evidently made by mixing chalk, salt and quicklime, with caustic soda and glue. The materials for it cost about 2½ cents a pound.

Another powder is made of about 67 parts crystallized soda, (which is 63 per cent. water), 19 of sand and 14 of pulverized lignite. The materials cost 4.4 cents per pound, and the powder is sold for 17½ cents a pound.

An incrustation fluid is six-sevenths water, while about one-twelfth is carbonate of soda, with a little caustic soda and salt and Glauber's salts, with some organic substances containing a little tannic acid. It is sold for 6½ cents a quart and costs less than 1 cent.

Another boiler fluid is nearly eight-ninths water, and the other 11.6 per cent. of it are made up of carbonate of lime, salt, carbonate of barytes, chalk, ammonia and some organic matters containing tannic acid, probably tan bark. The association gives notice that this not only is not good, but that the presence of ammonia and salt makes it harmful to the boiler plates.

The "dimensions to be observed for railways in India on the 5 ft. 6 in. gauge," as given in the *Indian Engineer*, include quite a number of details which would be accepted here only after protest, and even some which seem absurd. Perhaps the most so, according to American ideas, are the specified dimensions of ties and rails. The ties are 8 ft. apart, 10 ft. (9 ft. 11 in.) long and 10 x 5 in. section, and the rail put on these ties only 62 lbs. per yard and has 4 in. base. Over this kind of superstructure it is permitted to run engines loaded with 12 tons (44,800 lbs.) per axle, and even in some cases 14 tons. The sizes of ties are an exact copy of English practice, where it is justified by the use of heavy rails and of chairs on

each tie, and the high cost of ties, which are all imported. Under the quite different conditions of Indian practice, except as to the cost of ties, the combination seems in every way unfortunate.

The curves for "ordinary country" are to be 1,500 ft. radius (3 deg. 50 min.) and "in difficult country" 800 ft. radius (7 deg. 10 min.). The "ruling gradient for ordinary railways" is to be "1 in 150" or 0.67 per cent. (35 ft. per mile) and in difficult country 2 per cent. No water tank must come within 30 ft. of the track, water cranes being always used. The road-beds are to be 20 ft. on fills and 18 ft. (excluding side drains) in cuts. "For calculations connected with girder bridges, the live load uniformly distributed over the entire span for a single line of rails may be assumed to be"—various loads decreasing from  $2\frac{1}{4}$  tons per foot run for 40 ft. spans to 1.42 tons for 150 ft. spans. The rolling stock specified is substantially according to English practice in all its leading dimensions.

#### THE SCRAP HEAP.

##### An Old Locomotive Engineer.

To-day is the 42d anniversary of the time when Mr. Porter King entered the employ of the Boston & Albany Railroad as locomotive engineer, and he is running to-day, as he has done steadily through the 42 years. Mr. King began railroading on the old Mohawk & Hudson line at Albany on Sept. 1, 1835. For a distance of 14 miles toward Schenectady, the road was a steep incline, and horses were used, Mr. King acting as driver. He afterward drove in the same way at Brooklyn and Jersey City, making four years of such service. Then he fired a locomotive between Jersey City and New Brunswick, N. J., for five years. Coming to Springfield as an engineer, he ran on various trains between Worcester and Albany. He now makes three round trips to Westfield daily. Next Wednesday will thus complete his 51st year at railroading, and he has the satisfaction of looking back upon half a century of the most faithful service.—*Springfield (Mass.) Homestead*, Aug. 28

##### Punishing a Defaulter in Canada.

William T. Steward, Manager for the Western Union Telegraph Co. at Wichita, Kansas, who absconded on Aug. 10, a defaulter for about \$1,700, has been apprehended at Winnipeg, Manitoba, and is being prosecuted by his bondsman, the American Surety Co., of No. 160 Broadway, New York. The Western Union Co. was also promptly reimbursed by the Surety Co. This is an important case, and its decision may tend to diminish the defaulting and absconding which is encouraged by the lack of a Canadian extradition treaty covering this class of offenses. The American Surety Co. acted with great spirit in securing the arrest, and is prosecuting the defaulter at Winnipeg under the Dominion act, 32-33 Victoria: "An absconder with money stolen in the United States can be arrested and punished criminally in Canada on the complaint of any one."

##### A Runaway Accident.

A dispatch from Grayling, Mich., Sept. 2, says: "At Blodgett & Byrne's logging railroad, 8 miles from here, yesterday, the engine left the train at the top of a grade, took one brakeman, and went a short distance to take on wood. While the cars at the top of the grade were being loaded, one car got away from the men and ran down the grade into the engine. The engineer, fireman, and brakeman had just finished loading the tender and had climbed into the engine to start back when the car struck them. The engine and tender were destroyed, and Ernest Wilcox, fireman, and James Moshier, brakeman, were instantly killed. The engineer escaped with serious, but not necessarily fatal, injuries. The brakeman was found a distance from the engine in a hole dug beside the track with a log lying on him, and the hole filled with water. The fireman was just putting wood into the fire-box, and was crushed against it and horribly burned."

##### Train Robbers.

A Chicago dispatch of Sept. 1 says: "Five tramps, Cleveland Charley, Captain Ebbs, Brick Henry, Jack Williams and an unknown man, are now believed by detectives to be the perpetrators of the Rock Island train robbery last March, when Messenger Nichols was killed and \$21,000 stolen from the express car. Cleveland Charley and Captain Ebbs are at present under sentence to the penitentiary for a burglary committed in Milwaukee, and the detectives are close on the track of the others. The first clew, it is said, was obtained from the keeper of a tramps' boarding-house, in Chicago, whom Cleveland Charley gave a bundle of bloody clothing to keep until called for. Further details are withheld by the officers."

##### Shooting at Trainmen.

Engineers in the employ of the West Shore Railroad complain that it has not been an unusual thing for bullets from a hidden weapon to whiz past their heads while riding in their cars between Cornwall and Roncont. The thing happened so frequently that a scouting party went in search of the shooters on Tuesday of this week. Between two rocks at a point just outside of Cornwall they found a man crouched with a rifle in his hands. He gave the name of Rundon. He proved to be insane. God, he said, had given him instructions which he refused to reveal. His attempt to kill the trainmen was a part of the programme.

##### In the Smoker.

The liar was telling some of his friends in the smoking-car how he was a government contractor during the war, and on one occasion he worked in 5,000 pairs of shoes with pasted soles.

"Was that just before Second Bull Run?" queried a farmer-looking man on a seat near by.

"I believe it was."

The farmer pulled off an old shoe and exhibited a bunion as big as his fist.

"I got a pair of your shoes," he said as he stood up, "and they made this bunion and lame me up so that I was captured and spent six months in Andersonville. Stranger, prepare to git the darndest licking on this earth."

The liar had to admit that he was only 16 years old when the war closed, and to furnish the bunion man with a cigar.—*Wall Street News*.

##### An Obliging Company.

A curious relic of early railroading has just been received by General Passenger Agent Ruggles of the Michigan Central Railroad Co. It is in the shape of a letter indorsing a pass issued to G. W. Curtis and lady over the Michigan Central from Detroit to Chicago, and was dated 30 years ago. Mr. Curtis at that time was selling tickets for the Michigan Central at Winona, Minn., and after receiving his free transportation mislaid it. It coming to light among some old papers last week, he promptly forwarded it, asking a renewal of the privilege. This was promptly granted, Passenger Agent Whitney replying that in case the new pass had not been used at the expiration of 30 years, the company

would promise to again renew it. The old pass will be preserved in the office as a relic.

##### An Explosion in an Express Car.

The Ellenville (N. Y.) *Journal* says that Express Agent Launt and Baggage Master Jones were treated to a very undesirable bath on the New York, Ontario & Western road, Thursday, Sept. 2, by the exploding of a barrel of yeast consigned to Kuhlmann, the brewer, just as the train entered Phillipsport. A report like that of a cannon and a deluge of yeast persuaded the nimble expressman to abandon the car, while the baggage man, who was less fortunately situated, was compelled to stand and take it. Both the men and all the contents of the car were thoroughly soaked.

#### TECHNICAL.

##### Locomotive Building.

The New York Locomotive works in Rome, N. Y., recently shipped 2 narrow-gauge engines to the Portland & Willamette Valley road in Oregon.

The Delaware, Lackawanna & Western shops in Kingston, Pa., have just completed a mungo freight engine with a new style of furnace for burning waste anthracite.

The Roanoke Machine Works in Roanoke, Va., are building 10 consolidation engines for the Norfolk & Western road. These engines have 20 by 24 in. cylinders and 50 in. drivers. The boilers are 56 in. diameter, and the fire-boxes are 42 in. wide and 102 in. long inside.

##### The Car Shops.

The Boston & Maine shops in South Lawrence, Mass., are building two combination baggage and smoking cars for the road. The shops are now busily engaged in removing the Smith vacuum brake from passenger trains and replacing it with the Westinghouse automatic brake. The passenger trains on the Eastern Division are already provided with the Westinghouse brake.

The Pennsylvania Co. has now contracts out for 6,000 freight cars, which are divided up in a number of shops.

##### Bridge Notes.

The Smith Bridge Co. in Toledo, O., has just completed an iron bridge over the Bayou St. John, La. The draw span of this bridge is 138 ft. long.

The Phenix Bridge Co. in Phenixville, Pa., have just completed a highway bridge at Clyde, R. I., which is 110 ft. span.

The St. Louis Bridge & Iron Works has received a contract for a highway bridge over the Big River in Jefferson County, Mo. The company has a number of contracts for highway bridges on hand.

##### Manufacturing and Business.

The Union Switch & Signal Co. in Pittsburgh has recently received a heavy order for interlocking signals and switches for the Pittsburgh, Fort Wayne & Chicago road.

The Westinghouse Machine Co. in Pittsburgh has just delivered a 60 H.P. Westinghouse engine to the Cleveland Electric Light Co., being the sixth engine made for that company.

The California Land & Lumber Co. is building a new saw-mill at Mohawk, California, in which line shafting will be entirely dispensed with, and three independent Westinghouse engines will be used for their circular saw, gang mill and edgers.

##### Iron and Steel.

Katherine Furnace at Boiling Springs, Pa., went into blast last week and is now making about 40 tons of pig iron per day.

Vigo Furnace in Terre Haute, Ind., is being made ready to go into blast.

The Braddock Wire Co. has completed a rolling mill at Braddock, Pa., for rolling steel wire rods.

Franklin Furnace in Sussex County, N. J., one of the largest blast furnaces in the United States, is now running on one-third anthracite coal and two-thirds coke. The furnace was built to use anthracite as fuel.

The Ewald Iron Co. will start up the Tennessee Rolling Mill at Louisville, Ky., as soon as necessary repairs can be made. The company will manufacture plate and bar iron from Tennessee charcoal blooms.

The Bethlehem Iron Co., in Bethlehem, Pa., has just completed a shipment of 9,500 tons of steel rails to the Northern Pacific road, and is now filling an order for 2,500 tons for the Chicago, Milwaukee & St. Paul.

Chester Furnace in Morris County, N. J., has been repaired and went into blast last week.

##### The Rail Market.

*Steel Rails.*—No change is reported, and prices are steady at \$34@\$35 per ton at Eastern mills, with a number of orders reported.

*Rail Fastenings.*—A good business is reported, with prices unchanged at 20 cents per lb. for spikes in Pittsburgh: 2.75@\$3.10c. for track-bolts, and 1.65@\$1.80 for splice-bars.

*Old Rails.*—Old iron rails are scarce and in greater demand, and prices are higher, quotations being \$21@\$22.50 per ton at tidewater. Old steel rails are quoted at \$22@\$23 per ton in Pittsburgh.

##### Electric Headlight for Locomotives.

The Lake Shore & Michigan Southern Co. is experimenting with an electric headlight, made after the pattern devised by Mr. George Paul. The light is on a passenger engine running between Cleveland and Erie. It is stated that Mr. Paul will shortly introduce his system of lighting cars on a passenger train on this road.

##### Guaranteed Steel Rails.

It is reported that the order for 20,000 tons of steel rails by the Chicago, Burlington & Quincy Railroad for 1887 delivery has been placed with an American mill. We understand that, like the famous English contract by the same railroad, this order calls for special quality, and that involves a five year guarantee; that 20 per cent of charcoal iron was demanded, and the question of quality was to be decided by the railroad. The specification, too, contained a clause by which the mill was to be charged with actual cost of cutting off battered ends, with \$1.50 per rail in addition.—*Iron Age*.

##### American Society of Civil Engineers.

At the regular monthly meeting of the society in New York, Sept. 1, the recent death of Mr. Chesbrough, past President of the society, was announced, and a committee was appointed to prepare an appropriate memorial.

The chief business of the meeting was the discussion of the report of progress made by the Committee on the Strength and Compression of Cements and the Settlement of Masonry. The committee presented a large number of figures, with some comments.

The meeting was closed by an informal discussion of the recent earthquake, in which a number of members who had been in earthquake countries stated their experiences.

##### Springs for Stock Cars.

The New York Central & Hudson River Co. has for some time past been running trains of 20 stock cars, 10 having the trucks fitted with elliptic springs and 10 with the Voss

graduated springs. The performance of these cars has been carefully watched, and the result has been that the Superintendent of Motive Power and Cars has been requested by the General Live Stock Agent to use the Voss graduated spring under all stock cars hereafter.

The Michigan Central recently had 250 stock cars built with the graduated spring, and these cars have been in general demand by stockshippers, as they have proved to be exceptionally easy riding cars and very light on stock carried in them.

##### An Electric Railroad in Detroit.

The Detroit Electric Railway on Dix avenue was opened to traffic yesterday, although it will be several days yet before trips are made on schedule time. Mr. Charles L. Van Depoele, of Chicago, inventor and proprietor of the Van Depoele system, arrived Monday to witness the maiden trip of his electric train. The motor, which is styled "The Van Depoele," in honor of the inventor, was hauled from the Antoine street barn by horses over the city railway lines in the morning, and connection made for the first trip about 1 p. m., when Mr. Van Depoele, accompanied by Manager Turnes, boarded the motor, the former grasping the lever.

Full speed was not attempted during the afternoon, owing to the fact that numerous small boys who followed the motor up and down the lines kept the track covered with sand, and the gauge is not perfect at every point. The passenger cars, two in number, were connected to the motor about 5 p. m., and the full train then made its first trip successfully.

The body of the cars are painted a substantial red color with yellow trimmings, and are distinguishable by the words "Detroit Electric Railway." The motor, fashioned out of one of the smallest of the old City railway cars, is 10 ft. in length and will be used as a smoker. Its weight is 10,000 pounds. The train has a carrying capacity of 100 persons, and it is estimated that a round trip can be made in 15 minutes, although the schedule time will be about 30 minutes.—*Detroit Tribune*, Sept. 1.

##### Narrow Gauge Lines in the United States.

The *Journal of the Franklin Institute* contains the following table compiled up to July 1, 1886:

	No. of railroads.	No. of breaks
Narrow-gauge railroads in the U. S.	211	12,829 353
Broad-gauge (5 ft. and over) railroads in the U. S.	14	187 15
Total number of breaks of gauge in the U. S. ....		370
In 1884. ....		To June 30, 1886.
Total mileage of railroad track laid in the U. S. ....	3,997	3,200 1,755
Mileage of narrow-gauge railroad track laid in the U. S. ....	552	534 258
Percentage of narrow-gauge track laid, about. ....	14	17 14.7
Miles track laid in 1886 now under construction.		Miles to be completed in 1886 to be constructed.
Narrow gauge railroad in the U. S. ....	258	437 1,553
Total railroad mileage in the U. S., Dec. 31, 1884. ....	125,379	
Mileage railroad construction in the U. S. for 1885. ....	3,200	
Mileage railroad construction in the U. S. for 1886 to July 1. ....	1,755	
Total railroad mileage in the U. S. to July 1, 1886. ....	130,334	
Total narrow-gauge railroad mileage. ....	12,829	
Less 713 miles Mexican National Railway in Mexico. ....	713	
Total narrow gauge railroad mileage in the U. S. ....	12,116	

being 9.2 per cent of the railroad system of the United States.

It is, however, admitted that 2,000 miles of existing narrow-gauge will shortly be changed to standard. After the change there will still remain over 10,000 miles of narrow-gauge lines, exclusive of roads operated by private parties for lumbering, mining, etc., and which are not open for public business, and are not, therefore, included in any list of railroads.

There are a few miles of 2 ft. gauge, and two lines, 15 miles long still exist of 6 ft. gauge. Various odd gauges 3 ft. 1 in., 3 ft. 2 in., 4 ft. 1 in. and 4 ft. 3 in. are represented by a few scattered lines of no great mileage. The lines of the 3 ft. 6 in. gauge are more numerous, but of course the great bulk of the narrow-gauge lines are on the 3 ft. gauge.

##### Sault Ste. Marie Canal.

The statistical report for August of the Sault Ste. Marie canal has just been issued, and shows an increase of business over any previous month in the history of the canal. The number and class of vessels that passed through the canal is as follows: Steamers, 732; sail vessels, 458; rafts and registered craft, 45; making a total of 1,250, with a total number of lockages of 591. The aggregate of registered tonnage passing through was 708,496 tons; freight, 747,097 tons, and the number of passengers 7,960. The registered tons are 219,314 and the freight 197,725 tons greater than during August, 1885. This freight tonnage is 12,479 tons greater than during any other month in the history of the canal.

##### A Railroad in Patagonia.

Even Patagonia is to have a railroad, a vessel being now on its way from England with rails and other material for the new road, which is to be built at the Welsh colony of Chubut, in that portion of Patagonia belonging to the Argentine Republic.

##### The Smallest Engine.

The smallest oscillating engine in the world has been made by John R. Hare, at 63 West Fayette street, for Prof. E. M. Worth, of Harris' Museum. Its bore is  $\frac{1}{16}$  in. and the stroke  $\frac{1}{8}$  in. The wheel shaft and crank weigh 8 grains, the cylinder 5, and the stand and pillar 12 grains, making the whole weight 1 pennyweight 1 grain. It is about the size of a half-grown collar button, and is completely covered by a number five or child's thimble. It will be run by compressed air. It makes 3,000 revolutions a minute. Mr. Hare has also made a comparative giant, which is covered with an English walnut shell.—*Baltimore Sun*.

##### Freight Train Brakes.

The recent brake trials at Burlington seem to have given considerable impetus to freight brake matters. The equipment of 1,000 cars with the Westinghouse brake for the Colorado Midland road has already been noted, and we are now informed that the Erie road has begun the equipment of a large number of its cars with the same brake, orders for 400 sets having been given within the last few days.

##### Pile-Driving by Dynamite.

It is said that an engineer of Pesth, Hungary, Mr. Pradjanovic, has lately used dynamite for driving piles. A circular cast-iron plate, 15 in. in diameter, and  $3\frac{1}{4}$  in. thick, is fixed on the pile to be driven, in a perfectly horizontal position. A dynamite cartridge made in the form of a disc 6 in. in diameter, and  $\frac{1}{4}$  in. thick, and containing 17 $\frac{1}{2}$  ounces of dynamite, is placed upon the cast iron plate and exploded by electricity. It is stated that the depth to which the pile is driven by each explosion is equal to five blows of an ordinary pile engine weighing 14 $\frac{1}{2}$  Vienna cwt., falling 9 ft. 10 in. A cast-iron plate on an average resists 25 explosions.

## General Railroad News.

## MEETINGS AND ANNOUNCEMENTS.

## Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

*Chicago & Eastern Illinois*, annual meeting, at the office in Chicago, Oct. 5, at noon.

*Housatonic*, special meeting, in Bridgeport, Conn., Sept. 15, to vote on the lease of the Danbury & Norwalk road.

*Louisville & Nashville*, annual meeting, at the office in Louisville, Ky., Oct. 6, at noon.

*Nashville, Chattanooga & St. Louis*, annual meeting, in Nashville, Tenn., Sept. 15. Transfer books closed June 18.

*Northern Pacific*, annual meeting, at the office in New York, Sept. 16. Transfer books closed Aug. 2.

*Ohio & Mississippi*, annual meeting, at the office in Cincinnati, Oct. 14. Transfer books close Sept. 18.

## Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

*Missouri Pacific*, 1% per cent., quarterly, payable Oct. 1.

*Sunbury & Lewistown* (leased to Pennsylvania Railroad Co.), 3 per cent., semi-annual, payable Oct. 1.

## Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Brake Committee of the Master Car-Builders' Association* will hold a meeting at No. 73 Broadway, New York, at 10 a. m., on Thursday, Sept. 16.

The *Brotherhood of Locomotive Firemen* will hold its annual convention in Minneapolis, Minn., beginning on Wednesday, Sept. 15.

The *National Association of General Passenger & Ticket Agents* will hold its next meeting at the Hotel Brunswick in New York on Tuesday, Sept. 21.

The *General Time Convention* will hold its fall meeting in New York, on Wednesday, Oct. 18.

The *Western Society of Engineers* holds regular meetings at its hall, No. 15 Washington street, Chicago, at 7:30 p. m. on the first Tuesday of each month.

## Foreclosure Sales.

The *Havana, Ranout & Eastern* road was sold in Springfield, Ill., Sept. 7, under a decree of foreclosure of mortgage, and was bought for \$500,000 by Anthony J. Thomas, as Trustee for the bondholders. The road extends from West Lebanon, Ind., to Leroy, Ill., and was formerly part of the Wabash system.

The *New Castle Northern* road was sold in Pittsburgh, Pa., Sept. 2, and was bought for \$75,000 by W. W. Reed, of Erie, Pa. The road was intended to run from New Castle, Pa., to Middlesex, 15.2 miles. The right of way was procured and some grading done, and work was stopped on account of a quarrel among the stockholders, which resulted in the election of two boards of directors. The sale was made under a judgment obtained by the contractors.

## ELECTIONS AND APPOINTMENTS.

*American Society of Civil Engineers*.—At the regular meeting of Sept. 1 the following elections were announced:

Members: Josiah Ackerman Briggs, Carl W. Buchholz, Wm. Rumble, Frank W. Skinner, New York; Charles L. Rowland, Thomas Fitch Rowland, Jr., Brooklyn, N. Y.; Wm. Johnson Sprout, Montreal; Thomas M. R. Talcott, Mobile, Ala.; Alfred E. Hunt, Pittsburgh, Pa.; Jones M. Jackson, Wynne, Ark.; Francis E. Butterfield, San Antonio, Tex.

Juniors: Edward L. Abbott, Wm. C. Brown, Montgomery Waddell, New York; Wm. Cushing Eedes, Boston; George Robertson Hooper, Montreal.

*Atchison, Topeka & Santa Fe*.—Mr. George L. Sands is appointed Superintendent of the Rio Grande Division, with office at San Marcial, N. M., vice Mr. P. F. Barr, resigned, to date from Sept. 1.

*Boston, Hoosac Tunnel & Western*.—Mr. O. L. Van Woert is appointed General Freight Agent in place of Wm. M. Clark, resigned. Mr. Van Woert has been for some time Agent at Mechanicville. Mr. F. B. Furnald succeeds Mr. Clark as General Passenger Agent.

*Calumet River*.—The directors of this new company are: J. T. Torrence, W. M. Wilson, A. N. Sullivan, C. G. Gunther and W. A. Ball.

*Central Vermont*.—At the annual meeting in St. Albans, Sept. 8, the following directors were chosen: J. Gregory Smith, E. C. Smith, St. Albans, Vt.; J. R. Langdon, Montpelier, Vt.; W. H. H. Bingham, Stow, Vt.; Joseph Hickson, Montreal; E. H. Baker, Boston.

The same directors were chosen for the *Consolidated Railroad Co. of Vermont*, whose property the Central Vermont Co. operates.

*Chicago, & Atlantic*.—At the annual meeting in Huntingdon, Ind., Sept. 2, the following directors were chosen: James H. Benedict, Hugh J. Jewett, Thomas B. Musgrave, A. L. Hopkins, C. L. Atterbury, George J. Bippus, C. C. Waite, Thomas Eddy, Andrew W. Kent. The only change from the old board is that Andrew W. Kent succeeds Samuel B. Smith, of New York.

*Chicago, Burlington & Northern*.—Mr. A. C. Sheldon is appointed General Western Passenger and Freight Agent, with office in Portland, Oregon. He was formerly on the Chicago, Burlington & Quincy and more recently on the Texas & St. Louis road.

*Chicago, Milwaukee & St. Paul*.—The following appointments were officially announced by General Manager Roswell Miller, under date of Aug. 31:

Mr. A. J. Earling is appointed First Assistant General Superintendent, with jurisdiction and authority over all lines of this company, to take effect Sept. 1. Mr. C. H. Prior having resigned the position of Assistant General Superintendent, Mr. C. W. Case is appointed in his stead, with office at Minneapolis. He will have jurisdiction over the following lines: River Division, Dubuque Division, Wabasha Division, Chippewa Valley Division, Hastings & Dakota Division, Iowa & Minnesota Division; the new lines from Andover to Harlem, from Ioway to Bowdell, from Ellendale north, and from Roscoe north and south, as they may be completed, are attached to the Hastings & Dakota Division. The Iowa and Dakota Southern, Minnesota and the Sioux City & Dakota Divisions will report direct to Milwaukee. Mr. W. J. Underwood is appointed Superintendent of the River and the Dubuque divisions, with office at LaCrosse, Wis., to take effect Sept. 15, pending which Assistant General Superintendent Case will retain direct charge of those divisions. Mr. L. B. Beardsley is appointed Superintendent of the Sioux City & Dakota Division, with office at Sioux City, Ia., to take effect Sept. 15. The new line from Scotland to Mitchell and its branch, from Tripp to Armour, when completed will be attached to the Sioux City & Dakota Division. Mr. T. H. Dancy is appointed Assistant Superintendent of the LaCrosse and the Wisconsin Valley divisions, to take effect Sept. 1.

*Chicago & Northern*.—The directors of this new company are: Harvey S. Hayden, Allan C. Knapp, Wm. G. Witherell, Fred W. Story and Byron G. Cowan, all of Chicago.

*Fayetteville & Little Rock*.—The office of this new company is in Fayetteville, Ark.; the directors are H. F. McDaniel, J. H. Fairbanks, J. S. McDaniel, J. F. Mayo, D. B. Elliott, J. H. Van Hoose, J. N. Brown, J. I. Pickens, and B. F. McDaniel.

*Gainesville, Henrietta & Western*.—The officers of this new company are: H. M. Hoxie, President; J. Herrin, Vice-President; D. S. H. Smith, Secretary and Treasurer; J. M. Lindsay, Assistant Secretary and Treasurer. The headquarters of the company will be in Gainesville.

*Helena & Red Mountain*.—This company has elected officers as follows: President, S. T. Hauser; Vice-President, E. L. Bonner; Secretary, Harry Barbour; Treasurer, T. C. Power. Office at Helena, Montana.

*Jacksonville, Manatee & Gulf*.—The officers of this new company are: President, H. M. Drane, Savannah, Ga.; Vice-President, W. S. Warner, Palma Sola, Fla.; Secretary and Treasurer, J. M. Barre.

*Joliet, Aurora & Northern*.—The officers of this company are: President, G. B. Shumway, Chicago; Vice-President, Daniel Robertson; Secretary, E. E. Wood; Treasurer, H. H. Evans, Aurora, Ill.; General Superintendent, H. L. Evans, Joliet, Illinois.

*Kansas City, Memphis & Birmingham*.—The office of Capt. A. W. Gistler, Principal Assistant Engineer, has been removed from Memphis, Tenn., to Tupelo, Mississippi.

*Lake Shore & Michigan Southern*.—General Superintendent P. P. Wright on Sept. 1, issued the following circular: "Mr. T. J. Charlesworth is appointed Superintendent of the Michigan Division, with headquarters at Toledo, Ont., vice Mr. J. E. Curtis, resigned. Mr. G. H. Worcester is appointed Superintendent of the Detroit Division, with headquarters at Detroit, Mich., vice Mr. T. J. Charlesworth, transferred. These appointments taking effect on this date."

*Louisville, New Albany & Chicago*.—Mr. George Stevens is appointed General Purchasing Agent, with office in Chicago. He was recently Assistant Purchasing Agent of the Chicago, Burlington & Quincy.

*Louisville, New Orleans & Texas*.—The following, from Vice-President and General Manager James M. Edwards, is dated Memphis, Aug. 25: "Mr. A. J. Knapp having resigned as General Freight and Passenger Agent of this company to accept a similar position with another line, Mr. E. W. How has been appointed to succeed him, taking effect this date. All correspondence or business relating to said departments will be addressed to Mr. How at Memphis, Tennessee."

*Missouri Pacific*.—The following official order is dated St. Louis, Sept. 4: "Mr. C. V. Lewis is appointed Assistant General Freight Agent, with office at Kansas City, Mo. He will have charge of the freight traffic originating on the lines in Kansas, Missouri and the Indian territory, south of and including Kansas City, Mo., Wyanotte, Junction City and Salina, Kan., and west of and including the line, Kansas City to Joplin, Missouri."

"Mr. W. C. Smith is appointed Assistant General Freight Agent, with office at St. Louis, Mo. He will have charge of the freight traffic on the lines in Missouri and Arkansas, excepting the territory described above."

"Mr. W. H. Garrott is appointed Division Freight Agent, with office at Atchison, Kan. He will have immediate charge of the freight traffic of the lines north of Wyanotte, Kan., to Atchison, Kan., and St. Joseph, Mo.; also that of the Central Branch Division, Nebraska Extension and Lincoln Branch, reporting direct to the general freight office at St. Louis."

"The offices of Division Freight Agent at Sedalia, Mo., and Commercial Agent at Kansas City, Mo., and Atchison, Kan., are hereby abolished."

*New York, Lake Erie & Western*.—Mr. H. C. Thompson is appointed General Roadmaster of the New York, Pennsylvania & Ohio line, to date from Sept. 1. His office will be in Cleveland, O. Mr. J. M. Larned succeeds Mr. Thompson as Division Roadmaster of the Eastern Division of the New York, Pennsylvania & Ohio. Mr. Larned will continue also to act as Roadmaster of the Buffalo & Southwestern Division.

*New York, Woodhaven & Rockaway*.—Messrs. Austin Corbin, H. W. Graves, J. R. Maxwell and H. W. Maxwell have been chosen directors to fill vacancies made by the resignation of D. D. Conover, A. S. Hatch, W. D. Hatch and T. W. Orcutt.

*Penokee*.—The incorporators of this new company are Joseph L. Colby, Abbott Lawrence, John Martin and Howard Morris—all officials of the Wisconsin Central.

*Pullman's Palace Car Co.*.—The following circular was issued by President Pullman on Sept. 1: "The positions of Eastern General Superintendent and Western General Superintendent of this company have been abolished. Mr. E. H. Goodman, heretofore Eastern General Superintendent, has been appointed Second Vice-President of this company, in special charge of the construction department, with headquarters at Chicago. Mr. T. H. Wickes, heretofore Western General Superintendent, has been appointed General Superintendent of this company, with headquarters at Chicago."

General Superintendent T. H. Wickes issued the following circular: "A new division of this company is hereby established, with office at Oakland Pier, Cal., to be known as the Western Division, taking effect this date. Said division will comprise the following lines, now embraced in the San Francisco District, and such additional lines as may from time to time be added thereto, namely: No. 266, San Francisco and Las Vegas; No. 267, Los Angeles and National City; No. 274, Los Angeles and Las Vegas; No. 275, San Francisco and Ogden; No. 280, San Francisco and Raymond; No. 284, San Francisco and El Paso. Mr. J. P. Merman, Assistant Superintendent of this company at Oakland Pier, is hereby appointed Superintendent of said division, and will be responsible and obeyed accordingly."

*St. John Valley*.—Mr. H. A. Hancox is appointed Chief Engineer, with office in Fredericton, N. B. He was recently Engineer in charge of the Hudson (Mass.) Water-works.

*Stockton, Hill City & Western*.—The directors of this new company are: M. C. Revelle, Stockton, Kan.; H. A. Coffin, Jr., W. R. Hill, Hill City, Kan.; W. A. Lindsey, Kirwin, Kan.; M. Quirk, Gettysburg, Kan.; R. R. Hayes, Osborne, Kan.; J. W. Chesbrough, St. Louis.

*Virginia Construction Co.*.—Mr. R. L. Traylor has been elected Treasurer of this company, vice W. C. Watts, re-elected, with office in Memphis, Tenn. Mr. T. T. Talley has been appointed Auditor, vice J. W. Daniel, resigned.

*Wilmington, Onslow & East Carolina*.—This company was organized at Wilmington, N. C., Sept. 1, when the following directors were elected: J. W. Atkinson, E. E. Bur-

russ, A. D. Brown, W. H. Chadbourne, Thomas Evans, D. L. Russell and E. S. Martin.

## PERSONAL.

—Mr. I. H. Wilson, Chief Engineer of the Kansas & Arkansas Valley Railroad, died at Pierce City, Mo., Aug. 28, of typhoid malaria. His body was taken to his former residence at Toledo, O., for interment.

—Mr. George Stevens has resigned his position as Assistant General Purchasing Agent of the Chicago, Burlington & Quincy Co. to accept a position on the Louisville, New Albany & Chicago. Mr. Stevens has been connected with the Burlington Co. for 15 years past.

—Mr. Francis Funk, for many years Emigrant Agent of the Pennsylvania Railroad Co., died at his residence in Philadelphia, Sept. 6, aged 68 years. Mr. Funk was a native of Germany, but came to this country when quite young, and was highly esteemed by the officers of the company.

—Mr. A. Jackson has resigned his position as Assistant Master Mechanic of the St. Louis Division of the Wabash, St. Louis & Pacific road. He has been connected with the road for 19 years. The employes of his division presented him with a handsome watch and chain on his retirement.

—Mr. Nathan Binnix, Master Car-Builder of the Cumberland & Pennsylvania Railroad, died at his residence in Mt. Savage, Md., Sept. 3, aged 65 years. Mr. Binnix was a native of England, but came to this country when a young man, and had been in the service of the Cumberland & Pennsylvania road over 30 years.

—Mr. Octave Chanute, the well-known engineer, at the meeting of the American Association for the Advancement of Science in Buffalo, N. Y., last month, acted as Vice-President of the Mechanical Science Section. Mr. Chanute delivered an interesting address on the progress of mechanical science and the field open to the members of the association.

—Mr. William Jervis died in Milwaukee, Wis., Sept. 7, aged 73 years. He was formerly an engineer, and was engaged in the construction of the old Milwaukee & Mississippi road, now part of the Chicago, Milwaukee & St. Paul. After its completion he was Manager of the road for 10 years. He was a brother of the late John B. Jervis, the eminent civil engineer.

—The Springfield (Mass.) *Republican* of Sept. 4 says: "The Boston *Advertiser*'s story that Gov. Robinson has been offered the place of Chief Counsel to the Boston & Albany Railroad is news to that company. It also states Judge Soule's salary at \$15,000, which is five or six thousand too high. President Bliss himself gets only \$12,000, probably the highest railroad salary in New England."

—Major James Converse, for a number of years past Chief Engineer of the Galveston, Harrisburg & San Antonio road, has resigned his position, to date from Sept. 1. Major Converse resigns in order to devote his time to his duties as administrator of the large estate of the late Thomas W. Peirce, formerly President of the company. He will make his residence in Houston, Tex., for the present.

—Mr. J. E. Curtis has resigned his position as Superintendent of the Michigan Division of the Lake Shore & Michigan Southern road. He entered the service of the road 35 years ago as a brakeman, and rose gradually through the positions of freight conductor, passenger conductor and train dispatcher, until he was appointed Division Superintendent in 1865. It is understood that Mr. Curtis will retire from business altogether.

—Hon. Albert Gallatin Dewey died Sept. 2, at his residence in Quechee, Vt., aged 81 years. He was one of the projectors of the Woodstock Railroad, and for 13 years President of the company. He represented his town in the Vermont Legislature for several years and was State Senator four years. Mr. Dewey passed the whole of his long life in the town, and nearly all of it in the house where he was born.

—Mr. C. B. Robinson died at Monon, Ind., Sept. 9, aged 68 years. Mr. Robinson was at one time a railroad contractor, but in 1852 was appointed Roadmaster of the Indianapolis, Peoria & Chicago, and five years later Assistant Superintendent of the road. In 1870 he was appointed General Superintendent of the Indianapolis Union road, but three years later went back to the Indianapolis, Peru & Chicago as Superintendent. In 1877 he retired from business on account of failing health, but two years later went back to his old road as General Roadmaster, but after holding that position for a year again resigned and went into the lumber business.

## TRAFFIC AND EARNINGS.

## Big Lake Craft.

The successful launch of the new steel propeller "Susquehanna" at the Union Dry-Dock yard on Saturday, is a noteworthy incident in the history of the lake-shipping business. The vessel is 322 ft. in length, and will carry 100,000 bushels of wheat—that tells the story in a few words. She is the largest vessel on the lakes, and in her construction and finish will show many innovations upon ordinary lake shipbuilding, such as the steel deck, the arrangement of the screw, the machinery amidships, water ballast, etc.

Mr. G. B. Mallory, of New York, who designed the "Susquehanna," is also engaged to construct a similar vessel, though of 300 ft. greater length, for the Union Steamboat Co. It is evident that the day of big ships is at hand. Competition with the rail routes will often force rates down to a point where only vessels of the maximum tonnage can do more than pay expenses. The shallow waters of the St. Clair River and of many of our harbors forbid the introduction of vessels as large as some ocean steamers in our lake marine, but the limit of tonnage has not been reached yet. The maximum depth possible under existing conditions is 15½ ft., but a steady increase in carrying capacity is effected from year to year, by extending the other dimensions and by improved methods of construction. Two hundred years ago La Salle built the "Griffon" at Cayuga Creek, the first vessel that ever sailed upon the upper lakes; a tiny craft of 5 or 10 tons burden. Fifty years ago the biggest craft on Lake Erie carried 5,000 bushels of wheat. A little more than 20 years ago the "Merchant," the first iron vessel on the lakes, was built by the Messrs. Evans, now agents of the Anchor Line, owners of the "Susquehanna." To-day steel propellers costing a quarter of a million dollars, and carrying 100,000 bushels of wheat are required. The changes of the last 25 years in lake transportation have been very striking. Perhaps those of the next quarter of a century will be even more startling.—*Buffalo Commercial Advertiser*.

## Boston Traffic Notes.

During the month of August the New York & New England Railroad transferred steamer at Newburg, N. Y., transported 2,436 freight cars westward bound and 2,876 coming east. The same line also brought east 1,838 coal cars.

## Railroad Earnings.

Earnings of railroad lines for various periods are reported as follows:

Eight months to Aug. 31:		1886.	1885.	Inc. or Dec.	P. c.
Buff., N. Y. & P. R.	\$1,704,046	\$1,519,661	I. \$184,385	12.1	
Buff., R. & Pitts.	738,821	771,305	I. 12,484	1.6	
Canadian Pac.	6,175,600	5,002,405	I. 1,013,235	20.1	
Central Iowa	898,727	755,948	I. 42,779	5.6	
Chi. & Alton	4,972,591	5,032,931	D. 60,340	1.2	
Chi. & East. Ill.	1,089,474	1,003,191	I. 86,283	8.6	
Chi., Mil. & St. P.	14,648,000	14,272,845	I. 373,155	2.6	
Chi., N. W.	15,331,792	14,645,182	I. 588,900	9.0	
C. St. P. M. & O.	3,681,900	3,450,900	I. 221,900	6.4	
Chic. & W. Mich.	892,743	829,333	I. 63,140	7.5	
C., I., St. L. & C.	1,640,156	1,533,661	I. 112,495	7.5	
Denver & R. G.	4,107,536	3,846,835	I. 260,701	7.6	
Det., Lan. & No.	777,859	752,742	I. 25,117	3.3	
Grand Trunk	10,516,519	9,395,126	I. 1,21,383	11.9	
Illinois Central:					
Ill. lines	4,118,851	4,088,387	I. 30,404	0.7	
So. Division	2,233,916	2,611,743	D. 287,787	11.1	
Iowa lines	1,050,736	1,004,180	I. 45,556	4.6	
Ind., B. & W.	1,660,759	1,471,687	I. 135,072	9.2	
Long Island	2,029,949	1,923,428	I. 90,512	5.4	
Louis. & Nash.	8,782,192	8,970,986	D. 188,794	2.1	
Mexican Central.	2,360,410	2,406,854	D. 20,305	0.8	
Mil., L. S. & W.	1,441,607	816,146	I. 65,461	76.5	
Mil. & Northern	307,741	303,463	I. 34,288	9.5	
N. Y. City & No.	352,798	279,421	I. 73,372	29.7	
Norfolk & West.	1,937,949	1,644,197	I. 313,783	19.1	
Northern Pacific.	7,250,508	6,577,730	I. 681,778	10.4	
Ohio & Miss.	2,554,718	2,367,352	I. 87,366	3.7	
Ohio Southern	307,842	265,872	I. 41,970	15.8	
Oreg. R. & N.	3,214,813	2,736,944	I. 477,969	17.0	
St. Jo. & Gd. I.	732,444	633,993	I. 78,451	12.0	
St. P. & San. Fran.	2,903,160	2,671,371	I. 221,782	8.3	
St. P. & Duluth	845,246	744,564	I. 100,082	13.5	
St. P. M. & Man.	4,131,797	4,111,925	D. 90,128	2.1	
Wab., St. L. & P.	8,079,159	7,412,471	I. 666,988	10.6	
Wisconsin Cent.	916,178	936,799	D. 20,712	2.2	
Seven months to July 31:					
Atch., T. & S. F.	\$8,244,478	\$8,049,040	D. \$164,562	1.9	
Net earnings...	3,602,526	3,650,602	D. 47,476	1.3	
Chi., Bur. & Q.	13,654,100	14,185,801	D. 331,701	2.3	
Net earnings...	6,013,087	5,850,622	I. 162,465	2.8	
Mil., L. S. & W.	1,191,213	681,925	I. 509,288	74.6	
Net earnings...	514,962	180,804	I. 324,068	170.6	
Union Pacific	14,048,146	13,559,520	I. 518,626	3.8	
Net earnings...	4,143,046	4,287,446	I. 144,400	3.4	
Six months to June 30:					
Peoria, Dec. & E.	\$337,367	\$328,480	I. \$8,878	2.7	
Net earnings...	142,998	133,310	I. 9,688	7.3	
Month of June:					
Peoria, Dec. & E.	\$56,921	\$17,944	I. \$8,977	18.7	
Net earnings...	23,616	17,274	I. 6,342	37.2	
Month of July:					
Atch., T. & S. F.	\$1,301,110	\$1,181,784	I. \$121,326	10.3	
Net earnings...	659,759	535,073	I. 124,686	23.3	
Canadian Pac.	988,348	907,638	I. 90,710	10.0	
Net earnings...	458,222	445,579	I. 12,643	2.8	
Chi., Bur. & Q.	2,330,741	1,812,834	I. 517,967	7.4	
Net earnings...	1,168,954	694,976	I. 473,978	67.8	
Louis. & Nash.	1,259,774	1,057,332	I. 202,412	19.2	
Net earnings...	546,453	364,445	I. 182,008	49.8	
Mil., L. S. & W.	248,444	116,272	I. 132,172	113.8	
Net earnings...	93,490	36,756	I. 56,734	154.2	
Union Pacific	2,442,058	2,304,900	I. 137,068	5.9	
Net earnings...	981,724	1,012,750	D. 31,035	1.1	
Month of August:					
Buff., N. Y. & P.	\$257,700	\$228,900	I. \$28,900	19.6	
Buff., R. & P.	136,301	110,084	I. 26,217	23.8	
Cairo, V. & C.	60,752	42,025	I. 18,727	44.6	
Canadian Pac.	99,000	802,000	I. 115,000	14.4	
Central Iowa	115,095	113,565	I. 1,530	1.3	
Chi. & Alton	747,922	725,602	I. 22,320	3.1	
Chicago & Atl.	141,060	98,980	I. 42,080	49.5	
Chi. & East. Ill.	165,968	148,736	I. 19,232	13.1	
Chi., Mil. & St. P.	1,973,000	1,766,911	I. 206,089	11.7	
Chi., N. W.	232,500	1,928,10	I. 366,400	20.5	
C. St. P., M. & O.	496,000	476,600	I. 19,400	1.1	
Chi. & W. Mich.	117,945	133,579	I. 4,366	3.8	
Cin., L. St. L. & C.	236,856	206,850	I. 30,006	18.7	
Denver & R. G.	614,690	562,734	I. 51,936	9.2	
Det., Lan. & No.	100,971	110,200	I. 9,229	8.4	
Grand Trunk	1,367,670	1,153,312	I. 244,358	21.2	
Illinois Central:					
Ill. lines	662,934	576,090	I. 86,835	15.2	
South. Div.	284,039	264,793	I. 20,146	7.6	
Iowa lines	159,479	120,349	I. 39,130	32.6	
Ind., Bloom. & W.	257,521	242,800	I. 14,721	6.1	
Lake Erie & W.	134,000	101,00	I. 33,000	32.6	
Long Island	404,793	380,904	I. 23,894	6.3	
Louis. & Nash.	1,190,535	1,076,681	I. 113,954	10.6	
Mexican Cen.	265,637	255,687	I. 10,000	3.0	
Mil., L. S. & W.	250,394	134,221	I. 116,173	86.7	
Mil. & Northern	54,086	42,667	I. 11,419	26.6	
N. Y. City & No.	48,267	30,390	I. 8,877	22.7	
Northern Pacific	1,172,225	971,289	I. 900,936	20.7	
Ohio & Miss.	300,805	344,938	I. 45,927	13.3	
Ohio Southern	45,351	30,043	I. 7,312	18.7	
Oregon R. & N.	450,141	443,900	I. 15,341	3.4	
St. Jo. & Gd. I.	73,87	60,428	I. 13,450	22.4	
St. L. & S. F.	450,761	368,445	I. 87,316	23.6	
St. P. & Duluth	144,493	128,526	I. 15,967	12.4	
St. P. M. & Man.	6,6,017	54,020	I. 102,297	10.5	
Staten Is. R. & R.	120,384	81,288	I. 39,006	48.2	
Wab., St. L. & P.	1,217,768	1,029,404	I. 188,364	18.3	
Wisconsin Cent.	113,888	107,365	I. 6,524	6.1	

Weekly earnings are usually estimated in part, and are subject to correction by later statements. The same remark applies to early statements of monthly earnings.

## Western Traffic Association.

A Chicago dispatch of Sept. 3 says: "The Western Managers' Committee, which was appointed some time ago to prepare a plan for the formation of a gross money pool on freight and passenger traffic between Chicago, St. Louis, Council Bluffs, Omaha, and Nebraska points, held its first meeting here to-day. Four items of the proposed plan were taken up, but upon them was a difference of opinion so great that no agreement seemed possible. It was decided that the new pool, if formed, should last five years, and that the territory included should be virtually that covered by the Western Freight Association. The question of settling the balances of the old freight association pool provoked an animated discussion. The roads over insisted that they could not afford to pay the balances, and the roads under declared that if they were not paid they would go into no new arrangement. The matter was dropped in this shape for the time being.

"The next and most serious question was one brought up by a motion that upon the new pool going into effect the Commissioner should award percentages to all the lines parties to the agreement, and that business should be evened up under them. If any road was dissatisfied it could appeal to a Board of Control. If the Board of Control failed to agree it should appoint one arbitrator, and the Commissioner another, and if these two failed to agree they should appoint a third arbitrator to give the decisive vote, the decision of the Board of Arbitration to be final and the percentages awarded to remain in effect for one year, after which another appeal might be taken by the roads dissatisfied. Traffic Manager Smith, of the Wabash, declared point blank that his road would assent to no such proposition. The old freight association, he thought, was still in existence, and if that could not live no new pool could. The new proposition was simply a scheme to evade evening up percentages in the old pool by the lines that were ahead. Mr. Smith found

nobody to agree with him that the old pool still had any life in it, and upon this snag the committee stuck, and with it still under discussion it adjourned.

"There is but little prospect that the committee will arrive at a satisfactory conclusion, and like the Northwestern committee it will probably decide to submit a majority and minority report to the general meeting of the managers."

## Coal.

Anthracite coal tonnages reported for the week ending Aug. 28 were 588,857 tons. The total for the eight months to Aug. 28, as given by the weekly reports, was 19,402,866 tons, against 18,175,516 last year; an increase of 1,227,350 tons, or 6.8 per cent. The unusual agreement in the trade apparently continues, and no cutting of prices is reported.

Bituminous coal tonnages for the eight months to Aug. 28 are reported as follows:

	1886.	1885.	Inc. or Dec.	P. c.
Cumberland, all lines	1,403,892	1,771,566	D. 367,674	20.7
Horn. & Broad Top	249,333	191,703	I. 147,630	145.2
Barclay, B. R.	126,828	156,217	D. 29,380	19.0
Beech Creek	635,564	479,600	I. 155,055	35.5
Pennsylvania R. R.:				
Clearfield	1,326,322	1,917,165	D. 590,843	30.8
Mountain District	450,587	337,467	I. 113,120	33.6
Penn. and Westmore.	737,557	751,719	D. 14,162	1.8
Minor districts	919,982	983,531	I. 236,451	34.6
Chesapeake & Ohio	751,756	694,138	I. 57,618	8.3
Norfolk & Western	540,872	371,044	I. 169,828	45.8
Total	7,142,683	7,204,159	D. 121,460	1.7

from 1 to 2 ft. Between Rantowles and Ravenel's station the track had to be cut in several places to relieve the expansion. Near New Roads station, 26 miles from Charleston, a fissure caused a wash-out in the road-bed 6 ft. wide and 7 ft. deep.

"This was the condition of things on Wednesday morning, and trains passed over the road at 6 o'clock on Wednesday evening. It speaks volumes for the intelligent zeal and energy which characterizes the administration of the Charleston & Savannah Railway.

"The labor on the road for the first 30 miles was so disorganized that it was impossible to commence work before 10 o'clock. To repair the track for the passage of trains it was necessary to bring all the force of the road from the south of Ravenel's as far as the Savannah River, amounting to 100 hands. These, together with a special train of 50 hands brought from the Savannah, Florida & Western road, were the whole force with which Capt. Craig accomplished such prompt and excellent work."

**Chicago, Burlington & Quincy.**—This company is pushing the work of laying the third track on its line from Chicago to Aurora, a distance of 40 miles. The third track is now completed from Chicago to Lawndale, and at several of the stations long sidings have been laid which will be used as part of the new track.

The Fairmont Branch of this company's Burlington & Missouri River line is now completed to Superior, Neb., 18 miles southwest from the late terminus at Strang, and 53 miles from Fairmont.

The statement for July and the seven months to July 31 is as follows:

	July.	Seven months.
	1886.	1885.
Freight	\$1,683,565	\$1,213,823
Passengers	505,188	460,205
Other	141,980	138,807
Total earnings	\$2,330,742	\$1,812,835
Expenses	1,161,788	1,117,859
Net earnings	\$1,168,954	\$694,976
	\$6,013,087	\$5,850,622

For the seven months the gross earnings decreased \$381,701, or 2.3 per cent., and the expenses \$494,166, or 5.9 per cent., the result being a gain in net earnings of \$162,465, or 2.8 per cent. The decrease in gross earnings was entirely in freight, passenger and miscellaneous receipts showing an increase.

**Chicago, Milwaukee & St. Paul.**—This company has opened for traffic a new extension in Dakota between Andover, Day County, and Harlem, Sargent County, a distance of 55.6 miles. The branch will be known as the Andover Line and will be part of the Hastings & Dakota Division. The following are the stations and distances on the extension, starting from Andover, which is on the Hastings & Dakota Division, 259 miles from Minneapolis: Langford, 14.9; Britton, 28.4; Newark, 38.4; Sargent, 48.6; Harlem, 55.6 miles. The line runs from Andover nearly due north, and is east of the James River.

**Chicago & Northern.**—This company has filed articles of incorporation to build a railroad from Chicago, northwest to Geneva Lake, Wis. The articles of incorporation provide that the road shall connect with one of the lines now entering Chicago.

**Chicago, Burlington & Northern.**—The issue of the new 8 per cent debenture bonds of this company is limited to \$3,250,000, and \$2,000,000 of them have been sold to E. Rollins Morse & Bro., of Boston, and Drexel, Morgan & Co., of New York. The new bonds are dated Dec. 1, 1886, and are either coupon or registered, at option of the holder, and it is stipulated upon the face of the bond that any second mortgage upon the road shall not exceed \$10,000,000, and that, should such a mortgage be executed, a sufficient part of it shall be set aside to meet the debentures as they mature.

**Cincinnati & Eastern.**—It is stated that the purchasers of this road at the recent foreclosure sale are the same parties who now control the Cincinnati, Hamilton & Dayton road, and that their intention is to change the road from 3 ft. to standard gauge, and to run its trains into Cincinnati over the Hamilton & Dayton tracks. It is also said that they will extend it from Portsmouth to Gallipolis.

**Cleveland, Lorain & Wheeling.**—The question of the right of this company to cross the Cleveland & Pittsburgh tracks at Bridgeport, O., which has caused some local excitement, has been finally referred to the court, and the case was to be heard this week.

**Denver Railroad & Land Co.**—This company has completed its railway from Denver, Col., to its coal mines at Scranton, a distance of 17 miles, and the road is now in operation, bringing coal to Denver.

**Detroit, Bay City & Alpena.**—On the extension of the main line from Black River, Mich., north to Alpena, 21 miles, the grading is nearly all completed and 16 miles of track have been laid. The remainder will be completed this month.

**East Georgia & Florida.**—The grading on this road is now nearly all completed and the bridges are finished. Track-laying has been begun, and it is expected that the rails will be laid by Dec. 1 next. The line runs from Jessup, Ga., on the East Tennessee, Virginia & Georgia, southward to Hart's Road, Fla., on the Florida Railway & Navigation Co.'s road, and is intended to give the East Tennessee road a line to Jacksonville.

**Eutawville.**—This road is now completed from Preg- nalls, S. C., the junction with the South Carolina Railway, north by way of Eutawville to Vance's Ferry, a distance of 24 miles. The completion of the road to this point was celebrated recently by an excursion from Charleston and various points on the line. The road forms a branch of the South Carolina road.

**Fremont, Elkhorn & Missouri Valley.**—This road is now completed to Douglas, Wyo., 134 miles west of last year's terminus at Chadron, Neb. Douglas, which is a few miles from Fort Fetterman, is to be the terminus for this year.

On Sept. 13, the Lincoln Extension of this road will be opened for traffic from Fremont, Neb., to Wahoo, 80 miles from Missouri Valley and 527.1 miles from Chicago. A list of stations, with distances from Fremont, is appended: Cedar Bluffs, 9.7; Colon, 16.5; Wahoo, 22.4 miles.

**Fort Worth & Denver City.**—The parties who have been engaged for some time in building a line from Montague, Tex., to Bowie and thence to Burlington have offered this company the right of way, 10 miles of graded roadbed and \$50,000 in cash if it will build the branch. The projected line is about 50 miles long.

**Gainesville, Henrietta & Western.**—This company has been organized to build a railroad from Gainesville, Tex., through Henrietta to Seymour in Baylor County. The company is controlled by the Missouri Pacific.

**Georgia Pacific.**—This company has finally decided to change its Western Division from 3 ft. to standard gauge,

and to extend the line from its present terminus at Jacksonville, Miss., eastward to a connection with the Illinois Central at Greenwood.

Work on the unfinished section between Coalburg, Ala., and Day's Gap is being pushed forward rapidly. Considerable work is also in progress on the improvement of the line from Atlanta westward to Birmingham.

**Hammond & Calumet River.**—This company has filed articles of incorporation in Illinois to build a railroad from a point in Hyde Park, on Lake Michigan, north of the mouth of the Calumet River, to Thornton, on the Illinois and Indiana State line, and thence back to a point south of the mouth of the Calumet River. The capital stock will be \$2,000,000.

**Houston & Texas Central.**—The latest proposition made to the bondholders of this company by the parties controlling the stock has failed, the time set having passed, while much less than a majority of the bonds has assented to the plan. The bondholders have evidently made up their minds to accept no proposition involving a reduction of interest or a sacrifice of any of their rights. It is stated that no further proposition will be made.

**Jacksonville, Manatee & Gulf.**—This company has been organized to build a railroad from a point on the South Florida road to Sarasota, Fla., a distance of about 60 miles. It is said that surveys of the road have already been made and that work will be begun very shortly.

**Kansas, Nebraska & Dakota.**—Track on this road is now laid to Paris, Kan., 25 miles north from the late terminus at Laura, and 63 miles from the starting point at Fort Scott.

**Lake Erie & Western.**—The Hollins Committee publishes notice that they have concluded to submit to the existing parties to the agreement for their decision the following suggested modifications of its terms, viz.: Proposed new Eastern Division bonds to bear interest at the rate of 6, instead of 5 per cent.; Lake Erie & Western firsts to receive par and accrued interest in such new Eastern Division bonds, without addition of preferred stock, and Sandusky Extension firsts to receive 20 per cent. of their par in such preferred stock in addition to the amount of new Eastern Division bonds already provided for. Special deposits of Lake Erie & Western first mortgage bonds and Sandusky Division first mortgage bonds will be received by the Central Trust Co., up to Sept. 20, 1886, to be held for further deposit under the agreement of Feb. 1, 1886, in the event of adoption of the proposed modification of such agreements, but otherwise to be returnable to depositors.

**Lake Shore & Michigan Southern.**—The dispute in relation to the right of way and ownership of the yard in Erie, Pa., has been settled by a compromise, and the suits pending will be withdrawn. The title to the property was claimed by both companies, but the basis of settlement is an acknowledgment by the Lake Shore that the title to the property is in the Erie & Pittsburgh Co. In return that company agrees to allow the Lake Shore free use of the yard.

**Litchfield & St. Louis.**—This road, which is in the interest of the St. Louis & Chicago Co., is reported finished from Litchfield, Ill., south 8 miles to the coal fields at Mt. Olive.

**Louisville, Evansville & St. Louis.**—The bond-holders who are taking part in the reorganization of this company are asked to subscribe to an issue of \$2,000,000 first mortgage bonds, bearing 6 per cent. interest, to be secured by a general lien on all the property of the company, subject only to the first mortgage on the Evansville Division. These bonds are to be used to provide funds to put the road in good condition and to purchase equipment. One half of them are to be issued at once, and the balance as required.

**Louisville & Nashville.**—The statement for July, the first month of the fiscal year, is as follows:

	1886.	1885.	Increase.	P. c.
Earnings	\$1,259,774	\$1,057,332	\$202,442	18.9
Expenses	713,320	605,887	17,433	2.5

Net earnings \$346,454 \$361,445 \$185,000 51.4

Expenditures for construction and improvements this year were \$20,872, leaving a net balance of \$325,582 for the month.

**Maricopa & Phenix.**—Contract has been let for the building of this road from Maricopa, Ariz., on the Southern Pacific road, northward to Phenix, a distance of 36 miles.

**Mexican Railroad Notes.**—The following notes are from the *Mexican Financier* of Aug. 28:

In June, 1884, a concession was granted for a railroad from Mérida to Ticul, state of Yucatan, construction to begin within six months, only 4 kilometers to be built yearly. On account of failure to fulfill this contract the concession is officially declared forfeited.

The Tolosa & Cuernavaca Railroad Co., has organized with the following officers: President, Ignacio Marion y Valle; Secretary, Manuel de la Hoz; Treasurer, Joaquin Cortina; directors, Antonia Ramos Cadena, Narciso A. Menéndez, Francisco de P. Ricardo and Ramon Ballina.

The projected railroad from Pátzcuaro to Tacámbaro, Uruapan, Tarántan and Ario is in reality a circuit road, beginning at Pátzcuaro and coming back to the same place, where it will connect with the Pacific Division of the National. The project excites great interest in that section, and would, without doubt, be a paying road.

In May, 1882, a concession was granted to a company to build a railroad to unite San Luis Potosí with the Central Railroad between Celaya and Querétaro, construction to be commenced within 10 months and building to be done at the rate of 50 kilometers a year. This condition not having been complied with, the concession is officially declared forfeited.

**Midland, of Indiana.**—The track on this road is now laid to Eagletown, Ind., 5 miles west of the late terminus at Westfield, and work is progressing steadily toward Lebanon.

**Milwaukee, Lake Shore & Western.**—The gross and net earnings for July and for seven months were as follows:

	July.	Seven months.
	1886.	1885.
Gross earnings	\$248,444	\$116,272
Operating expenses	154,954	79,516

Net earnings \$93,490 \$36,756 \$54,962 \$190,894

The very large increase this year is due to the completion of the road to Ashland and the opening of the iron ore traffic from the mines on the Gogebic Range.

**Minneapolis & Pacific.**—Track has now been laid from Minneapolis, Minn., west 21 miles; from Glenwood, Minn., west 24 miles, and from Fairmount, Dak., west 10 miles, making a total of 55 miles. The line is under construction from Minneapolis to a point 30 miles west of Fairmount, a distance of 218 miles.

**Minnesota & Northwestern.**—A Chicago dispatch reports that this company, which has hitherto sent its Chicago business over the Illinois Central, has made an arrangement

by which it will have the use of the Chicago, Burlington & Northern and the Chicago, Burlington & Quincy tracks from East Dubuque to Chicago for the present and the permanent use of the Chicago, Burlington & Northern from East Dubuque to Freeport when its own line from Freeport eastward is finished.

On the extension of this road to Dubuque (the Dubuque & Northwestern road) track is laid to Fredericksburg, Iowa, 82 miles southeast from Dubuque Junction, Minn. (near Hayfield), and 30 miles beyond the last reported terminus. The intermediate stations are: Renova, Taopi, Bailey, Riceville, Elma and New Hampton.

**Missouri Pacific.**—This company has concluded negotiations with a syndicate represented by Kuhn, Loeb & Co., Drexel, Morgan & Co., August Belmont & Co., Morton, Bliss & Co., L. Van Hoffman & Co., Heidelbach, Iskelheimer & Co., J. Kennedy, Tod & Co., Maitland, Phelps & Co., Unger, Smithers & Co., and the National Bank of Commerce, for the extension of the \$7,000,000 first-mortgage gold 6 per cent. bonds maturing in August, 1888, for a period of 50 years at the rate of 4 per cent., thus reducing annual fixed charges by the sum of \$140,000.

**Mobile & Girard.**—At a conference held Sept. 2, in Savannah, Ga., a lease of this road to the Central Railroad Co. of Georgia was agreed upon and the necessary papers drawn up, to be approved as soon as they can be ratified by the stockholders of the two companies.

**New York, Lake Erie & Western.**—A fire broke out in the yard in Jersey City on the afternoon of Sept. 4, starting in a small shed used for the storage of oil. It extended to the Pullman car shed, where the sleeping-cars were kept when not on the road. This was destroyed, with 8 Pullman cars, nothing being left of them but the trucks. The fire extended to the freight houses used by the New York & Greenwood Lake and the Northern Railroad of New Jersey, both of which were destroyed, with several cars and a considerable quantity of freight. The total loss is estimated at about \$200,000. The fire caused considerable trouble, as the buildings burned were close to the main track leading into the passenger station, and for some time it was impossible for passenger trains to run into or out of the station.

**New York & New England.**—Reports are current that the control of this road has practically been transferred from Boston to New York by recent purchases. The New Yorkers who have been buying the stock are said to be Cyrus W. Field, Russell Sage and their associates. One statement says that not over 20,000 shares are left in the hands of Boston holders, which is probably an exaggeration. Another statement is that about 127,000 of the 200,000 shares are now held in New York, which is probably nearer the truth. It is certain that there has been heavy buying of the stock for account of New York parties, but the actual state of affairs will probably not be fully known until the annual meeting.

**Northeastern (South Carolina).**—The shops and stations of this road in Charleston, S. C., were damaged to the extent of nearly \$50,000 by the earthquake last week, the shops especially suffering. The road suffered less from damage to its tracks than the other lines entering the city, but the cost of repairs will be considerable.

**Ohio Valley.**—Track has been laid from Henderson, Ky., southeast to De Koven, a distance of 39 miles, being an extension of 11 miles. Grading is in progress between De Koven and Tradewater.

**Penokee.**—This company has been organized to build a road from a point on the Wisconsin Central near Bad River, Wis., eastward along the Penokee iron range to Hurley, a distance of 37 miles, and several short branches to reach iron mines are also proposed. The new line is intended to be a branch of the Wisconsin Central, and is organized by officers of that company. They offer the bonds of the new company to the amount of \$1,500,000 to the stockholders of the Wisconsin Central for subscription. Each subscriber for \$5,000 in cash will receive \$5,000 in 5 per cent. first-mortgage bonds of the new company, \$1,000 in income bonds and \$2,000 in stock. The subscription will close Dec. 11 next.

**Philadelphia & Reading.**—In the United States Circuit Court, in Pittsburgh, Sept. 2, Judge McKenna decided that testimony offered by President Gowen in the Robinson suit tending to show conspiracy on the part of the reorganization syndicate is inadmissible. The decision in full was as follows:

"This is only a renewal of an application made to the Court, with somewhat greater formality and expansion, and is probably disposed of by the result of that application and the reasons given for its refusal by the Judge who decided it. I do not propose to repeat those reasons or to reargue the questions then decided. It is sufficient to say that in my judgment the fundamental issues in the case were properly defined, and that the contested evidence is impertinent to those issues, and is therefore inadmissible. The second offer made by the defendant was not before the Court on the former occasion, and the competency of the evidence stated in it has not, therefore, been considered. I am unable now to see how the facts proposed to be probated can condone the fault of the mortgagee or are responsive in any way to the allegation of such default in the bill, which is explicitly admitted in the answer, without qualification. Hence, I cannot regard as admissible an offer of evidence touching a fact which is admitted to be true, and to which the answer in no other way refers than to admit the truth. This offer must, therefore, be rejected."

**Pittsburgh & Western.**—The narrow-gauge line of this road is now completed to Ormsby, Pa., 10 miles beyond the late terminus at Mt. Jewett. At Ormsby it connects with the Bradford, Bordell & Kinzua road, completing a line from Pittsburgh to Buffalo.

**Port Jervis & Monticello.**—Mr. W. H. Clark, receiver of this road, has given notice that he will apply to the New York Supreme Court at Newburg on Sept. 18 next for an order authorizing him to sell all the property of this company for the benefit of its creditors, and he will at the same time submit to the Court a statement showing all the outstanding claims against the company.

During the time which Mr. Clark has had charge of the road he has met all current debts and made considerable improvements in the property.

**Portland & Ogdensburg.**—At a meeting held in Portland, Me., Sept. 7, measures were taken to complete the transfer of this road from the Receiver to the new corporation organized by the bondholders.

**Portland & Willamette Valley.**—Work is progressing well on this road, and a large part of the grading and bridging is now completed. A construction train has been placed on the line and tracklaying is in progress. The road is the extension of the Oregonian Railway to Portland.

**Poughkeepsie & Southeastern.**—This company has filed articles of incorporation to build a railroad from Poughkeepsie, N. Y., southeast to Hopewell Junction on the New York & New England road, a distance of 12 miles. It is intended as a connection for the Poughkeepsie Bridge. Among

the incorporators are Homer A. Nelson, R. F. Williamson and J. A. Perkins, of Poughkeepsie; J. F. Sarle, L. M. Stone and A. L. Hill, of Brooklyn. The capital stock is \$500,000.

**Richmond & Danville.**—Under date of Aug. 31 the following circular was issued to the holders of debentures:

"By the terms of the mortgage deed of trust, securing the issue of the above named currency bonds, the Richmond & Danville Railroad Co. is required to provide for the interest upon said bonds after paying the interest upon all bonds secured by existing liens upon its property, the rental of all properties now leased by the said company, and its operating expenses. In its operating expenses shall be included expenditures made for the repair, renewal and improvement of its existing property, as well as for the purchase or construction of additional property and equipment necessary for the proper conduct of its business. The amount of interest to be paid in each year shall be determined by the board of directors within 60 days after Sept. 30 in each year, that being the termination of the fiscal year; and, when so determined, shall be paid in two semi-annual installments, viz.: on April 1 and Oct. 1 of each year, and in such proportions as the board may determine. But the said coupons, if unpaid, shall not bear interest. But this deed does not include, and is not intended to include, any stock or bonds which are now or may hereafter be owned by the Richmond & Danville Railroad Co., and the said Richmond & Danville Railroad Co. expressly reserves the right and absolute authority to sell or otherwise dispose of all stocks and bonds which are now or may hereafter be owned by it, as fully as if this deed had not been made."

"The company has been compelled to thus use its net revenue, and will be compelled, for some time to come, to apply its earnings to the completion of the steel rails upon its line, to the purchase of equipment, to the payment of car trusts, to the building of station houses, bridges, permanent culverts, and various improvements and betterments required to put its line into condition for the most economic operation, unless the means for so doing can be obtained from other sources."

"In order to provide for such betterments and improvements and to adjust its indebtedness upon an equitable and permanent basis, and to retire its outstanding obligations as they severally mature, the company proposes to issue a consolidated mortgage 5 per cent. gold bond, to run 50 years, secured by mortgage deed of trust, covering the property and rights of the company in its main, branch, leased and operated railroads."

"An amount of said bonds, equal to the present outstanding mortgage indebtedness of the Richmond & Danville Railroad Co. and the \$500,000 Northwestern North Carolina first-mortgage bonds guaranteed by this company, will be reserved to meet said outstanding obligations at par, and additional bonds, representing property and rights acquired subsequent to the execution of the debenture mortgage, may be issued at a rate not exceeding \$15,000 per mile of railroad."

"The company also reserves the right to issue, under this mortgage, bonds to an amount not exceeding \$2,500 per mile of railroad, for the exclusive purpose of purchasing additional equipment when hereafter required for the operation of the railroad, but limited to the actual cost of such additional equipment, as certified to the trustee of the mortgage."

"It therefore offers to the holder of each \$1,000 debenture bond (with Oct. 1, 1883, and subsequent coupons attached) \$1,180 in 5 per cent. gold bonds, bearing interest from Oct. 1, 1886, and \$29.50 in cash (being the equivalent of six months' interest on \$1,180, at 5 per cent. per annum).

"The company thus offers to the holders of what are only accumulative income bonds, a definite obligation possessing all the security of the debenture mortgage with the addition of properties subsequently acquired, with a fixed and permanent rate of interest, unaffected by any future needs of the company, and not subject to any omission or delay in the payment of interest by reason of expenditure of its earnings for improvements and renewals."

"This offer has received, in advance of its publication, the approval and acceptance of holders of a large amount of the debenture bonds."

**St. Louis, Arkansas & Texas.**—President Fordyce says of the change of gauge from 3 ft. to standard: "The road-bed is now ready. All necessary ties are in track, about all outside spikes driven, and all work necessary to be done on the whole line will be completed not later than Sept. 15. Sufficient standard cars and engines will be parked at points on the line by Oct. 10 to warrant the change of gauge on that date. The crisis in standard-gauging the road has been reached and passed, and we are now out of all possible danger."

"On account of using so many of our trains in construction, we have had to refuse in the last four months not less than 5,000 cars of paying freight, and in the last six months have hauled over 16,000 car-loads of new steel, old iron, ties and timbers of the company, and have used an average of 10 trains daily for the last 60 days in moving earth out of cuts and widening banks. We will not spend all the money estimated by the engineers as necessary for this purpose, and there has never been such a demand for timber products as now, and I estimate that from that source alone we will earn \$1,000,000 the first year after change of gauge."

**St. Louis, Fort Scott & Wichita.**—The Ellsworth, McPherson, Newton & Southeastern Branch has been extended from Newton, Kan., the terminus at the end of last year, northwesterly 12 miles. Grading is in progress between the end of track and King City in the direction of McPherson.

**St. Louis & San Francisco.**—The track on the Winfield Branch is now laid to Caldwell, Kan., 18 miles west of the late terminus at South Haven and 35 miles from Arkansas City.

**St. Paul, Minneapolis & Manitoba.**—The extension of the Devil's Lake Branch is now opened for business to Towner, Dak., the additional stations being Berwick, 68.75; and Towner, 76.07 miles west of Devil's Lake.

A new branch has been completed, extending from a junction with the Breckinridge Division, 4.26 miles west of Tintah, Minn., and 2.63 miles east from Campbell, westward to Hankinson, Dak. The stations on this branch, with the distances from the junction, are: Trent, Minn., 7.96; Berlin, Dak., 13.13; Sonora, 18.63; Hankinson, 25.50 miles.

The St. Cloud & Willmar Branch is now completed, and in operation from St. Cloud, Minn., on the main line west by south to Willmar, on the Breckinridge Division, a distance of 58.17 miles. The stations on this branch, with the distances from Willmar, are: O'Brien's, 3.90; Cold Springs, 15.77; Richmond, 20.15; Paynesville, 31.76; Hawick, 37.31; New London, 43.82; Spicer (Green Lake), 48.17; Willmar, 58.17 miles. This branch will be operated as part of the Breckinridge Division.

**South Carolina.**—The damage done to the stations, shops and other buildings of this road by the earthquake at Charleston is estimated at about \$100,000. Most of the buildings will have to be rebuilt. This does not include the damage done to the track outside of the city, which is not large at any point, but it is considerable in the aggregate.

**Stockton, Hill City & Western.**—This company has been organized to build a railroad from Stockton, in Rooks

County, Kan., westward to the westward line of Sheridan County. The distance is about 30 miles.

**Sunbury, Hazleton & Wilkesbarre.**—It is said that the Pennsylvania Railroad Co., which owns all the stock of this railroad, will offer to exchange for the second mortgage of the company a 60-year 5 per cent. bond guaranteed by the Pennsylvania Railroad Co. at par.

**Talbotton.**—The stockholders of this road have voted to lease it to W. K. Dennis & Co., who agree to operate the road and pay 5 per cent. on the stock. The lease is for 15 years. The road runs from Bostick, Ga., on the Central Railroad of Georgia, to Talbotton, 7 miles.

**Texas & Pacific.**—The interest upon the Texas & Pacific first mortgage due Sept. 1 was not paid. Last May the interest coupons were purchased by the Fidelity Trust Co., but no arrangement was made for the purchase of the interest matured on the 1st inst.

The Wistar-Fleming Committee give notice that the time until which income bonds and stock may be deposited with the Farmers' Loan & Trust Co. is limited to Sept. 30, after which date stock will only be received, if at all, upon payment of a penalty of \$2 per share. The contribution provided for under the plan will not be required at the time of deposit, but the same will become payable in installments of not more than \$2.50 per share, and upon notice of not less than 90 days.

The time for depositing bonds other than incomes, without penalty, expired on Sept. 3, and it is stated that about 92 per cent. of the bonds of the Rio Grande Division, the New Orleans Pacific, the general and terminal mortgage and the consolidated mortgage have come in.

The Land Grant and Income Bondholders' Committee give notice that the time for depositing bonds under their plan is extended to Sept. 30.

**Unaka Timber Co.**—This company, which owns some large tracts of timber land in Unicoi County, Tenn., has offered to build a railroad from Erwin in that county to Johnson City on the East Tennessee, Virginia & Georgia road, provided the county will issue \$25,000 in bonds in aid of the road. An election is to be held to decide the question.

**Union Pacific.**—The statement of earnings for July and for seven months is as follows:

	July.	Seven months.
Gross earn.	\$2,442,057	\$2,304,900
Oper. expenses.	1,376,699	1,216,837
Surplus.	\$185,358	\$188,153
Taxes.	83,635	75,993
Net earn.	\$981,724	\$1,012,750

**Net earn.** \$981,724 \$1,012,750 \$4 143,046 \$1,287,446

The total land sold for the eight months to Aug. 31 were 307,623 acres for \$1,051,905, against 696,018 acres for \$1,751,010 in the corresponding period last year.

The Manhattan & Blue Valley extension of the Omaha & Republican Valley road, owned by the Union Pacific, has been completed by laying track this year from Garrison, Kan., north to Marysville, a distance of 38 miles. The total length of the road from Manhattan to Marysville is 55 miles, of which 17 miles were built some two years ago. The extension makes a connection between the Union and the Kansas divisions.

**Western Union Telegraph Co.**—The statement for the quarter ending Sept. 30 is as follows, the September earnings estimated:

Net earnings	\$1,200,000
Interest and sinking funds	143,615
Balance for the quarter	\$1,056,385
Add surplus July 1	4,309,834
Total surplus Sept. 30	\$3,666,219

"The gross earnings from current land service on commercial messages continue to show an increase, and would be very satisfactory but for the great amount of business being done between the large commercial centres without profit if not at absolute loss. The cable business under the prevailing low rate has increased largely, and it is confidently hoped that the business will soon reach a volume that will yield a revenue equal to any ever before earned, and permanently establish cheap cable service.

"The Executive Committee recommend that no dividend be declared."

**Wilmington, Onslow & East Carolina.**—This company was organized at a meeting held in Wilmington, N. C., last week. The road is to run from Wilmington eastward to Onslow, and thence probably to Newbern and Washington.

#### ANNUAL REPORTS

The following is an index to the annual reports of railroad companies which have been reviewed in previous numbers of the current volume of the *Railroad Gazette*:

Page.		Page.	
Alabama Great Southern.	423	Maine Central.	68
Ala., N. O., Tex. & Pac. Junc.	423	Manchester & Lawrence.	414
Allegheny Valley.	563	Marquette, Houghton & Ont.	414
Americus, Preston & Lump.	492	Memphis & Charleston.	570
Arlington, Top. & Santa Fe.	492	Mexican Central.	486
Atlantic & West Point.	554	Michigan Central.	23, 31
Atlantic & N. E. Railroad.	554	Montgomery & Ohio.	486
Atlantic & Pacific.	594	Mississippi & Wabash.	191
B. & O. Employees' Relief Ass'n.	345	Minnesota & Northwestern.	518
Baltimore & Philadelphia.	15	Mississippi & Tennessee.	120
Boston & Lowell.	15	Missouri, Kansas & Texas.	367
Boston & Maine.	23	Missouri Pacific.	366
Boston & Providence.	15	Montgomery & Georgia.	493
Buffalo, N. Y. & Pittsburgh.	16	Montgomery & Wells River.	414
Bur. Cedar Rapids & No. 6.	622	Nashua & Lowell River.	514
Cairo, Vincennes & Chicago.	586	Nashua, Chittenden & St. L.	514
Camden & Atlantic.	518	Natchez, Jackson & Col.	104
Canadian Gov't Railroads.	272	Naugatuck.	21
Canadian Pacific.	343	New Haven & Northampton.	208
Central Pacific.	365	New London & W. H.	423
Charlottesville & Augusta.	155	North Central.	16
Charterers.	594	North & N. Y. Haven & Hartford.	23
Chesapeake & Dela. Canal.	414	N. Y. Ontario & Western.	30
Chesapeake & Ohio.	240	N. Y. Providence & Boston.	30
Cheshire.	104	N. Y. Rail Road Commission.	39
Ches. Burlington & Quincy.	202	N. Y. State & W. N. & W.	100
C. & G. Grand Trunk.	324	N. Y. West Shore.	210
C. & M. Milwaukee & St. P.	203, 224	Norfolk & Western.	68
C. & N. Northwestern.	414	Northern Central.	156
C. & N. Rock Island & Pac.	393, 423	Northern Pacific.	570
C. & S. St. P. Minn. & Omaha.	236	Norwich & Worcester.	120
C. & W. & Pittsburgh.	15	Northeastern (South Carolina).	18
C. & W. & Western Indiana.	45	Northeastern & L. Hampshire.	55
C. & W. & W. Michigan Valley.	394	Ohio & Mississippi.	55
C. & W. & W. & Dayton.	485	Oregon & Transcontinental Co.	553
C. & W. & W. & St. L.	558	Pacific Mail Steamship Co.	518
C. & W. & W. & St. L.	558	Panama.	307
C. & W. & W. & W. & Pitts.	622	Pennsylvania & New York.	224
C. & W. & W. & W. & Pitts.	622	Penns. Deltour & Evansville.	120
C. & W. & W. & W. & Pitts.	622	Philadelphia & Reading.	48
Cleveland & Canton.	192	Phila., Wil., & Baltimore.	307
Cleve., Col., Cin., & Ind.	208	Pittsburgh, Cin., & St. L.	394
Cleve., Lorain & Wheeling.	588	Pittsburgh & Lake Erie.	69
Cleve., Youngstown & Pitts.	622	Pittsburgh Junction.	55
Columbus & Greenville.	174	Pitts., Young., & W. H.	304
C. & H. Young V. & Tol.	192	Pitts., Wheeling & Ky.	304
Concord.	367	Portland & Ogdensburg.	120
Consolidation River.	55	Providence & Worcester.	120
Consolidation Coal Co.	139	Richmond & Alleghany.	50
Cumberland Valley.	307	Richmond & Danville.	50
Del. & Hudson Canan Co.	256	Richmond, Fred., & Potomac.	50
Del., Lacka., & Western.	104, 156	Rochester & Pittsburgh.	50
Denver & Rio Grande.	139, 556	Rome, Wat., & Ogdensburg.	50
Denver & Rio Gr. Western.	556		

Des Moines & Fort Dodge.	291	Rutland.	493
Detroit, Lansing & No.	323	St. L., Alton & Terre Haute.	583
Detroit, Gd. Haven & M.	324, 518	St. L., Iron Mt. & So.	367
Dublin & Wrightsville.	295	St. L. & San Francisco.	192, 343, 360
East Tennessee, Va. & Ga.	623	St. L., Van & Terre Haute.	292
Fitchburg.	174	St. Paul & Duluth.	155
Fulton & Potsdam.	174	St. L., Minn., & Manitoba.	104
Gardiner, C. & G.	307	Savannah, Fla., & Western.	344
Freight, C. & G.	307	Seaboard Valley.	587
Galveston, Houston & Hen.	367	Shenandoah Valley.	570
Georgia Pacific.	272	Southern Pacific.	535
Grand Trunk.	324	South Carolina.	208, 308
Gulf, Colorado & Santa Fe.	454	Southern Pacific Co.	470
Hannibal, Mo. & Gettysburg.	192	Sou. Ry. & S. C. & A. & D.	107
Housatonic.	192	Stewartstown.	388
Houston & Texas Central.	272	Terre Haute & Indianapolis.	470
Huntington & Broad Top Mt.	120	Terre Haute & Logansport.	470
Illinois Central.	174	Tol., Ann Arbor & N. M.	621
Indians & St. Louis.	208	Troy & Greenfield.	223
International & Gt. No.	160, 120	Union Pacific.	239
International & P.	160, 120	Utica & Black River.	272
Kans. City, Mo. & Gulf.	434	Vicksburg, Meridian.	122
Kans. City, Springfield & Mem.	485	Vicksburg, Shreveport & P. & F.	423
Kansas City Union Depot Co.	256	Virginia Midland.	139
Lake Shore & Mich. So.	314	Western Maryland.	139
Lehigh Coal & Navigation Co.	140	Western North Carolina.	192
Lehigh Valley.	140	West Jersey.	622
Little Miami & Cincinnati.	291	Wilmington & Col. & Augusta.	104
Little Miami & W.	291	Wilmington & Weldon.	104
Little Rock & F. Smith.	505	Wisconsin Central.	553
Louisville & Nashville.	293	Worcester, Nashua & Rock.	106
Louisville, N. Albany & Chi.	255	Wrightsville & Tennille.	231

#### Cincinnati & Eastern.</h4